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Section 1

General Information

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General Information

Introduction

Vehicle, Engine and Transmission ID and VIN Location, Derivative and Usage (Chevrolet)

5138041

The VIN plate is the legal identifier of the vehicle. The VIN plate (1) is located on the upper left corner of the instrument panel (I/P) and can be seen through the windshield from the outside of the vehicle:

Vehicle Identification Number (VIN) System

Position	Definition	Character	Description
1	Region of Build	1	United States
2	Manufacturer	G	General Motors
		H	Navistar Inc.
3	Vehicle Brand/Type	A	Chevrolet Bus (Non School Bus)
		B	Chevrolet Incomplete Truck
		C	Chevrolet Truck
		A	Chevrolet Incomplete Truck (Navistar Only)

Vehicle Identification Number (VIN) System (cont'd)

Position	Definition	Character	Description
4	GVWR/Brake System/Body Style	W	8,001–9,000 lbs/Hydraulic/Cargo Van/Four Door Cab/ Utility or Passenger Van
		Y	8,001–9,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		Z	9,001–10,000 lbs/Hydraulic/Cargo Van/Four Door Cab/ Utility or Passenger Van
		0	9,001–10,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		3	10,001–14,000 lbs/HydraulicCommercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		6	14,001–16,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
5–6	Chassis/Series	G/A	Chevrolet Express, 2500 Cargo
		G/B	Chevrolet Express, 2500 Cargo EXT
		G/E	Chevrolet Express, 2500 Passenger LS
		G/F	Chevrolet Express, 2500 Passenger LT
		G/G	Chevrolet Express, 3500 Cargo
		G/H	Chevrolet Express, 3500 Cargo EXT
		G/L	Chevrolet Express, 3500 Passenger LS
		G/M	Chevrolet Express, 3500 Passenger LT
		G/N	Chevrolet Express, 3500 Passenger LS EXT
		G/P	Chevrolet Express, 3500 Passenger LT EXT
		G/R	Chevrolet Express, 3500 Cutaway 139" Wheelbase
		G/S	Chevrolet Express, 3500 Cutaway 159" Wheelbase
		G/T	4x2, Chevrolet Express, 3500 Cutaway 177" Wheelbase
		G/U	Chevrolet Express, 4500 Cutaway 159" Wheelbase
		G/V	Chevrolet Express, 4500 Cutaway 177" Wheelbase
		G/9	Chevrolet Express (Non-US, Non-Canada)
7	Restraint System	B	AJ3 − Active Manual Belts, Airbag − Driver only − Front
		C	AK5 − Active Manual Belts, Airbag-Driver & Passenger-Front – Front (1st row)
		F	AK5 & ASF − Active Manual Belts, Airbags - Driver & Passenger - Front (1st row), Front Seat Side (1st row), Roof Side (All seating rows for vehicles with 3 or fewer seating rows; 1st, 2nd and 3rd row for vehicles with 4 or more seating rows)
		H	AJ3 & ASF - Active Manual Belts, Airbag - Driver only - Front, Front Seat Side (1st row), Roof Side (All seating rows for vehicles with 3 or fewer seating rows; 1st, 2nd and 3rd row for vehicles with 4 or more seating rows)
8	Engine Type	P	RPO LV1 – Engine Gas, 6 CYL, 4.3L, SIDI, V6, VVT, E85 MAX, Iron
		1	RPO LWN - Engine Diesel, 2.8L, DI, L4, DOHC, Turbo, XLDE
		7	L8T - ENGINE GAS, 8 CYL, 6.6L, SIDI, VVT, CAST IRON
9	Check Digit	—	Check Digit
10	Model Year	N	2022

Vehicle Identification Number (VIN) System (cont'd)

Position	Definition	Character	Description
11	Plant Location	1	Wentzville
		N	Springfield
12–17	Plant Sequence Number	—	Plant Sequence Number

2.8L RPO LWN Engine ID and VIN Derivative Location

Engine Identification

4.3L RPO LV1 Engine ID and VIN Derivative Location

Engine Identification

6.6L RPO L8T Engine ID and VIN Derivative Location

Engine Identification

6L90 (MYD) Transmission ID and VIN Derivative Location

Transmission Identification Information

8L90 (M5U) Transmission ID and VIN Derivative Location

Transmission Identification Information

Vehicle, Engine and Transmission ID and VIN Location, Derivative and Usage (GMC)

5138041

The VIN plate is the legal identifier of the vehicle. The VIN plate (1) is located on the upper left corner of the instrument panel (I/P) and can be seen through the windshield from the outside of the vehicle:

Vehicle Identification Number (VIN) System

Position	Definition	Character	Description
1	Region of Build	1	United States
		7	United States
2	Manufacturer	G	General Motors
		G	Navistar Inc. (7GZ Only)
3	Vehicle Brand/Type	D	GMC Incomplete Truck
		J	GMC Bus (Non School Bus)
		T	GMC Truck
		Z	GMC Incomplete Truck (Navistar Only)
4	GVWR/Brake System/Body Style	W	8,001–9,000 lbs/Hydraulic/CargoVan/Four Door Cab/ Utility or Passenger Van
		Y	8,001–9,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		Z	9,001–10,000 lbs/Hydraulic/CargoVan/Four Door Cab/ Utility or Passenger Van
		0	9,001–10,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		3	10,001–14,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
		6	14,001–16,000 lbs/Hydraulic/Commercial Special Cutaway, Two Door Cab pick-up or Motor Home Chassis
5–6	Chassis/Series	7/A	GMC Savana, 2500 Cargo
		7/B	GMC Savana, 2500 Cargo EXT
		7/E	GMC Savana, 2500 Passenger LS
		7/F	GMC Savana, 2500 Passenger LT
		7/G	GMC Savana, 3500 Cargo
		7/H	GMC Savana, 3500 Cargo EXT
		7/L	GMC Savana, 3500 Passenger LS
		7/M	GMC Savana, 3500 Passenger LT
		7/N	GMC Savana, 3500 Passenger LS EXT
		7/P	GMC Savana, 3500 Passenger LT EXT
		7/R	GMC Savana, 3500 Cutaway 139" Wheelbase
		7/S	GMC Savana, 3500 Cutaway 159" Wheelbase
		7/T	GMC Savana, 3500 Cutaway 177" Wheelbase
		7/U	GMC Savana, 4500 Cutaway 159" Wheelbase
		7/V	GMC Savana, 4500 Cutaway 177" Wheelbase
		7/9	GMC Savana (Non-US, Non-Canada)

Vehicle Identification Number (VIN) System (cont'd)

Position	Definition	Character	Description
7	Restraint System	B	AJ3 − Active Manual Belts, Airbag − Driver only − Front
		C	AK5 − Active Manual Belts, Airbag – Driver and Passenger – Front (1st row)
		F	AK5 & ASF − Active Manual Belts, Airbags - Driver & Passenger - Front (1st row), Front Seat Side (1st row), Roof Side (All seating rows for vehicles with 3 or fewer seating rows; 1st, 2nd and 3rd row for vehicles with 4 or more seating rows)
		H	AJ3 & ASF — Active Manual belts, Airbag - Driver only - Front, Front Seat Side (1st row), Roof Side (All seating rows for vehicles with 3 or fewer seating rows; 1st, 2nd and 3rd row for vehicles with 4 or more seating rows)
8	Engine Type	P	RPO LV1 – Engine Gas, 6 CYL, 4.3L, SIDI, V6, VVT, E85 MAX, Iron
		1	RPO LWN - Engine Diesel, 2.8L, DI, L4, DOHC, Turbo, XLDE
		7	mL8T - ENGINE GAS, 8 CYL, 6.6L, SIDI, VVT, CAST IRON
9	Check Digit	—	Check Digit
10	Model Year	N	2022
11	Plant Location	1	Wentzville
		N	Springfield
12–17	Plant Sequence Number	—	Plant Sequence Number

2.8L RPO LWN Engine ID and VIN Derivative Location

Engine Identification

4.3L RPO LV1 Engine ID and VIN Derivative Location

Engine Identification

6.6L RPO L8T Engine ID and VIN Derivative Location

Engine Identification

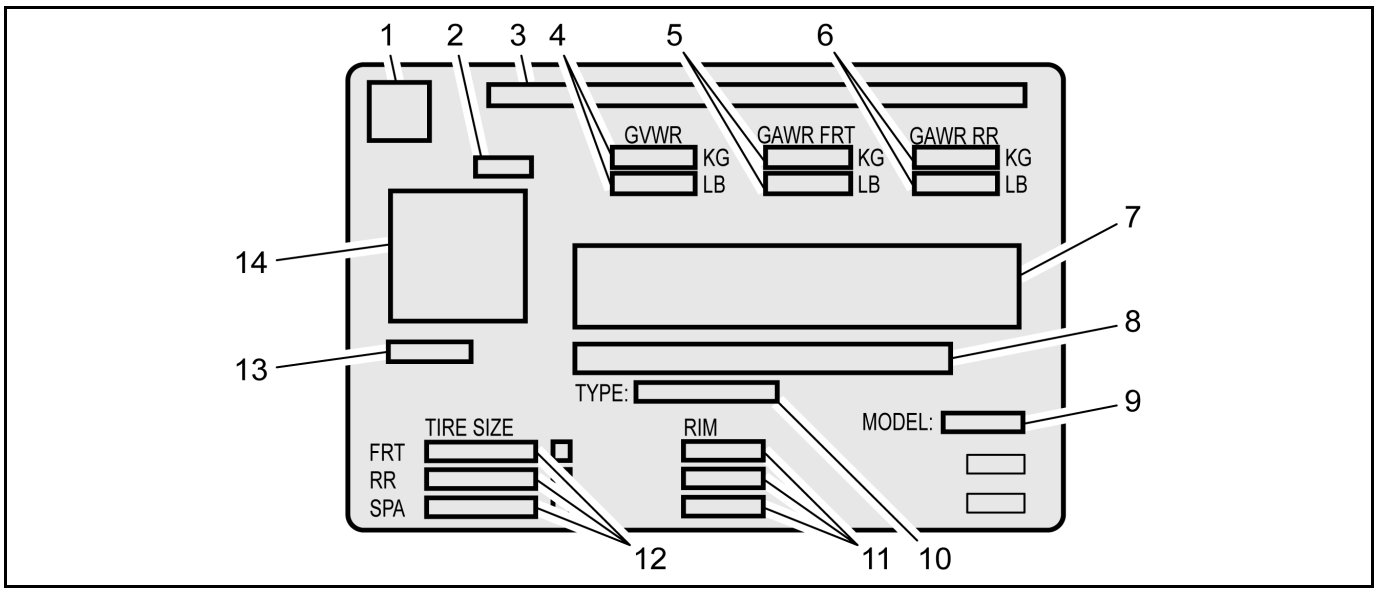
6L90 (MYD) Transmission ID and VIN Derivative Location

Transmission Identification Information

8L90 (M5U) Transmission ID and VIN Derivative Location

Transmission Identification Information

Vehicle Certification, Tire Placard, and Anti-Theft Label



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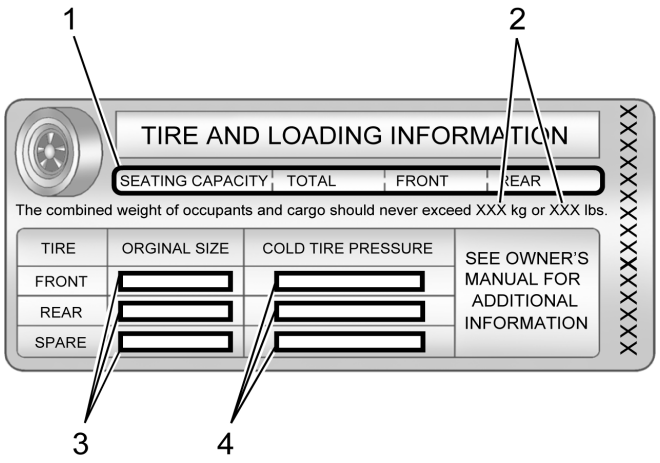
Vehicle Certification Label

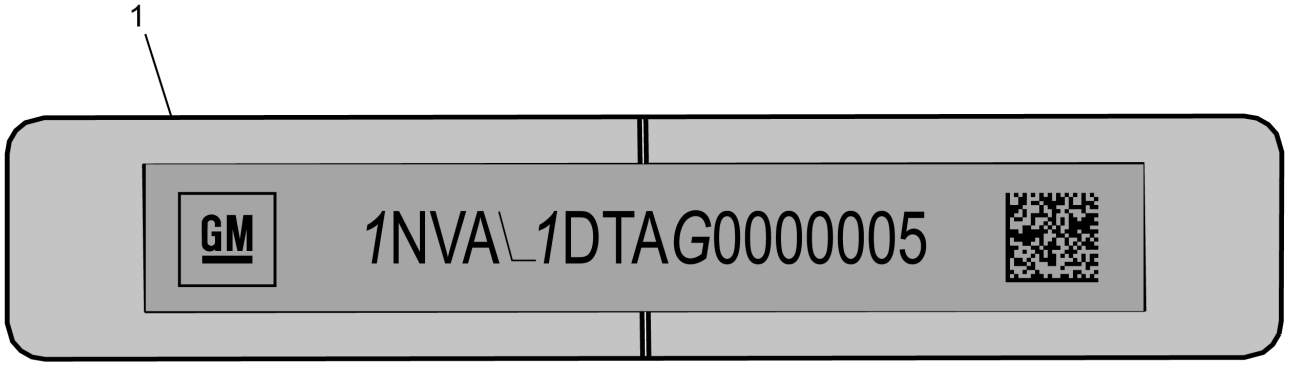
Callout	Description
A vehicle-specific Certification label is attached to the vehicle's center pillar (B-pillar) and displays the following assessments:	
1	Logo
2	Final Date of Manufacture (Month and Year MM/YY) Date of manufacture is to reflect the date that the vehicle is counted as built. In those cases where a replacement label is needed, the replacement label should reflect the actual build date not the date of replacement.
3	Name of Manufacturer
4	Maximum Gross Vehicle Weight Rating (GVWR)
5	Maximum Gross Axle Weight Rating (GAWR) - Front
6	Maximum Gross Axle Weight Rating (GAWR) - Rear
7	Certification Statement
8	Vehicle Identification Number (VIN)
9	Engineering Model Number
10	Vehicle Class Type (Pass Car, etc.)
11	Original Equipment Rim Size
12	Original Equipment Tire Size
13	Paint Code
14	QR Code Once the QR code is scanned, the information will appear in this order on your smartphone or laptop: VIN, Model Year, Model, Build Month, Year, Engineering Book, Vehicle Order Number, 3 Digit RPO Codes sorted alphanumerically and the Paint Code (same code appears the lower left of the QR code)



4962282

Tire Placard

Callout	Description
A vehicle-specific Tire and Loading Information label is attached to the vehicle's center pillar (B-pillar) and displays the following assessments:	
1	Specified Occupant Seating Positions
2	Maximum Vehicle Capacity Weight
3	Original Equipment Tire Size
4	Tire Pressure, Front, Rear, and Spare (Cold)



4962289

Anti-Theft Label

Callout	Description
This legal identifier is in the front corner of the instrument panel, on the driver side of the vehicle. It can be seen through the windshield from outside. The Vehicle Identification Number (VIN) also appears on the Vehicle Certification and certificates of title and registration.	
1	Vehicle Identification Number (VIN)

RPO Code List

The following table provides the description of the Regular Production Option (RPO) codes that are available on the vehicle. The vehicle's RPO list is printed on the Service Parts Identification Label.

RPO	Description
01U	PRIMARY COLOR-EXTERIOR, SPECIAL (02)
40P	WHEEL COLOR-WHITE (91)
52G	TRIM COMBINATION-CLOTH, MED NEUTRAL II (G) (00)
52I	INTERIOR TRIM-MED NEUTRAL II (I) (96)
52W	TRIM COMBINATION-VINYL, MED NEUTRAL II (W) (00)
5AZ	ACCESSORY-SAFETY KIT - UNIVERSAL
5C6	HOOK-CARGO TIE-DN
65C	LABEL, WARNING-CALIFORNIA, PROP 65 COMPLIANT
77S	LABEL, REGULATORY-CALIFORNIA, SECTION 177 STATES
93G	TRIM COMBINATION-CLOTH, MED DK PEWTER II (G) (03) (GMT610 - "G" VAN)
93I	INTERIOR TRIM-MED DK PEWTER II (03) (GMT610 - "G" VAN)
93W	TRIM COMBINATION-VINYL, MED DK PEWTER II (W) (03) (GMT610 - "G" VAN)
9EL	GOVERNOR-VEHICLE TOP SPEED LIMIT - 95 MPH
9L7	EQUIPMENT-ACSRY WRG JUNC BLK
A07	WINDOW-BODY
A08	WINDOW-BODY, RH
A12	WINDOW RR-DR, STA
A13	WINDOW SIDE DR-RR, STA
A17	WINDOW SIDE BODY-SWING OUT, LH
A18	WINDOW RR-DR, SWING OUT
A19	WINDOW SIDE DR-RR, SWING OUT
A31	WINDOW-POWER OPERATED, ALL DOORS
AG1	ADJUSTER FRT ST-POWER, MULTI-DIRECTIONAL, DRIVER
AG2	ADJUSTER PASS ST-POWER, MULTI-DIRECTIONAL
AJ1	WINDOW TINTED-DEEP, ALL EXCEPT W/S AND DRS
AJ3	RESTRAINT SYSTEM-SEAT, INFLATABLE, DRIVER, FRT
AJW	WINDOW STYLE-LAMINATED

RPO	Description
AK5	RESTRAINT SYSTEM-SEAT, INFLATABLE, DRIVER & PASS FRT
ANC	SALES PACKAGE-SHUTTLE BUS
AR7	SEAT-FRT BKT, STANDARD
AS5	SEAT-FRT BKT, DELUXE,
ASB	EQUIPMENT-SECURITY BAR, REAR SIDE DOOR
ASF	RESTRAINT-ROOF SIDE (LH & RH), SEAT SIDE (FRONT 1ST ROW), INFLATABLE
AT8	RESTRAINT PROVISIONS-CHILD, RR SEAT, RR FACING
ATG	LOCK CONTROL, ENTRY-REMOTE ENTRY, STANDARD RANGE
AU3	LOCK CONTROL-SIDE DR, ELEC
AXK	VEHICLE TYPE-TRUCK
AXW	VEHICLE TYPE-BUS- (NOT SCHOOL BUS)
B30	COVERING FLOOR-CARPET
B31	COVERING FLOOR-VINYL, FRT, FULL WIDTH
B32	COVERING FRT-FLOOR MATS, AUX (DNU NEXT NEW MAJOR)
B33	COVERING REAR-FLOOR MATS, AUX (DNU NEXT NEW MAJOR)
B38	COVERING FLOOR-VINYL, FRT & RR, FULL WIDTH
B3D	SALES PACKAGE-SCHOOL BUS
BA0	ORNAMENTATION-EXTR, DOOR, NAMEPLATE
BA3	COMPARTMENT-STOWAGE, I/P LOWER EXTENSION DELUXE
BAG	PARTS PKG-EXPORT
BNC	PARTS PKG-BODY MOUNT CUSHIONS
BTV	REMOTE START-VEHICLE
BUE	KIT-EXHAUST DIESEL
C36	HEATER-AUXILIARY
C42	HVAC SYSTEM-HEATER, OUTSIDE AIR, DELUXE
C49	DEFOGGER-RR WINDOW, ELECTRIC
C4K	GVW RATING-9,925 LBS
C4M	GVW RATING-9,900 LBS/4,500 KG
C60	HVAC SYSTEM-AIR CONDITIONER FRT, MAN CONTROLS
C69	HVAC SYSTEM RR-AIR CONDITIONER
C6P	GVW RATING-8,600 LBS/3,900 KG
C6Y	GVW RATING-9,600 LBS

RPO	Description
C7I	GVW RATING-14,200 LBS.
C7N	GVW RATING-12,300 LBS
C99	SWITCH-INFL RST I/P MDL MAN SUPPRESSION
CGN	LINER-PUBX, SPRAY ON
D28	MIRROR O/S-(-NONE)
D31	MIRROR I/S R/V-TILT
DAA	SUNSHADE-VINYL
DE5	MIRROR O/S-LH & RH, REMOTE CONTROL, ELECTRIC, HEATED, FOLDING, COLOR.
DH6	MIRROR I/S FRT VAN-LH & RH, SUNSHADE, ILLUM
DHC	MIRROR O/S-LH & RH, MANUAL CONTROL, AUX WFOV, COLOR
DNS	EQUIPMENT-SUPPLIER INSTALLED
DRJ	MIRROR I/S R/V-TILT, PARTIAL VIDEO DISPLAY
DSB	EQUIPMENT-SECURITY BAR DELETE, REAR SIDE DOOR
E24	DOOR SIDE-REAR, HINGED
E3T	HANDLE-I/S, DOOR RELEASE
E48	COVER-RADIATOR GRILLE OPG - COLD CLIMATE
EF7	COUNTRY-UNITED STATES OF AMERICA (USA)
ENC	HVAC PROVISIONS-AUXILLIARY HEATER PLUMBING & WIRING
EXP	EXPORT-
FE9	CERTIFICATION-EMISSION, FEDERAL
FHO	VEHICLE FUEL-GASOLINE E10
FHX	VEHICLE FUEL-DIESEL B20
G7C	PRIMARY COLOR-EXTERIOR, PULL ME OVER RED SOLID (130X)
G7K	EQUIPMENT-ANTENNA, CABLE AND GROUNDPLATE
G80	AXLE POSITRACTION-LIMITED SLIP
GAN	PRIMARY COLOR-EXTERIOR, SWITCHBLADE SILVER MET (G) 636R
GAZ	PRIMARY COLOR-EXTERIOR, SUMMIT WHITE (G) 8624
GBA	PRIMARY COLOR-EXTERIOR, BLACK (G) 8555
GT4	AXLE REAR-3.73 RATIO
GT5	AXLE REAR-4.10 RATIO
GU6	AXLE REAR-3.42 RATIO
IVR	VEHICLE-VRIDE
J22	ENGINEERING YEAR-2022
JFF	GVW RATING-10,100 LBS
JH6	BRAKE-HYD POWER, 4 WHL DISC. (DNU NEXT NEW MAJOR)
JH9	BRAKE-HYD POWER, 4 WHL DISC, 14,200 LBS (DNU NEXT NEW MAJOR)

RPO	Description
JL4	CONTROL,-ACTIVE BRAKE (DNU NEXT NEW MAJOR, CONTACT BFO FOR NEW STRATEGY)
K05	HEATER ENG-BLOCK
K08	HEATER-AUXILIARY, FUEL FIRED
K34	CRUISE CONTROL-AUTOMATIC, ELECTRONIC
K50	FUEL-FITTING, LINE TAKE-OFF
K68	GENERATOR-105 AMP
KC4	COOLING SYSTEM-ENG OIL
KD1	COOLING SYSTEM-TRANS, OIL
KG4	GENERATOR-150 AMP
KI4	RECEPTACLE I/P-ELECTRICAL, 110 VOLT
KUP	THROTTLE CONTROL-ELECTRONIC
KW5	GENERATOR-220 AMP
L8T	ENGINE-GAS, 8 CYL, 6.6L, SIDI, VVT, CAST IRON
LV1	ENGINE-GAS, 6 CYL, 4.3L, GEN 5, SIDI, V6, VVT, OHV, ALUM
LWN	ENGINE-DIESEL, 2.8L, DI, L4, DOHC, TURBO, XLDE
M5U	TRANSMISSION-AUTO 8 SPD, 8L90
MQD	TRANSMISSION-AUTO 8 SPD, 8L90, CPA, GEN 1
MTF	PROVISIONS-FIRE EXTINGUISHER MOUNTING
MYD	TRANSMISSION-AUTO 6 SPD, HMD, 6L90
N33	STEERING COLUMN-TILT TYPE
NAV	PLANT CODE-NAVISTAR, SPRINGFIELD, OH, USA
NCF	LOCK-CHILD SECURITY FEATURE - NONE
NE1	CERTIFICATION-EMISSION, GEOGRAPHICALLY RESTRICTED REGISTRATION
NE7	FUEL TANK-216L, 57 GAL
NE8	EVAPORATIVE SYSTEM-LEVEL 3 EMISSIONS
NHT	PERFORMANCE PACKAGE-ENHANCED TOWING
NP5	STEERING WHEEL-LEATHER WRAPPED (DNU NEXT NEW MAJOR)
NPL	PLATE-NAME - NONE
NTB	EMISSION SYSTEM-FEDERAL, TIER 3
NU9	EMISSION SYSTEM-CALIFORNIA, ULEV200
NUK	EMISSION SYSTEM-CALIFORNIA, ULEV250
NUM	EMISSION SYSTEM-CALIFORNIA, LEV3 MDV 10-14K GVW
P03	COVER, WHEEL-VAR 3
PNC	PANEL-TRIM, FRT DOORS & SI RR DOOR(S) & RR DOORS
PPC	PANEL-TRIM, RR DOORS

RPO	Description
QB5	WHEEL-16 X 6.5, J, STEEL
QT4	WHEEL-16 X 6.5, STEEL H.D.
R04	WHEEL CONFIGURATION-RR, SINGLE
R05	WHEEL CONFIGURATION-RR, DUAL
R25	APPEARANCE PACKAGE-EXTERIOR, CHROME GRILLE & PAINTED BUMPER
R26	APPEARANCE PACKAGE-EXTERIOR, CHROME GRILLE & FRONT BUMPER
RDI	ACCESSORY-KEYLESS ENTRY
RVG	ACCESSORY-ADAPTER - TRAILER HARNESS
RYT	ACCESSORY-FIRST AID KIT
RYY	ACCESSORY-FLOOR MATS - MOLDED VINYL
RZW	ACCESSORY-HARNESS - TRAILER HITCH
S08	ACCESSORY-HIGHWAY SAFETY KIT
S52	ACCESSORY-MOLDED HOOD PROTECTOR - SMOKED
S6N	ACCESSORY-RECEIVER COVER - TRAILER HITCH
SDD	ACCESSORY-TRAILER HITCH - FIXED
SDI	ACCESSORY-TRIANGLE - REFLECTIVE
SDS	ACCESSORY-WEATHER DEFLECTORS - SIDE WINDOW - SMOKED
SFE	ACCESSORY-WHEEL LOCKS
SFV	ACCESSORY-WIRELESS NETWORK INTERFACE MODULE
T74	CONTROL, HEADLAMPS-AUTOMATIC, DELAY (DNU NEXT NEW MAJOR)
TGA	LANGUAGE CONTROL-ENGLISH, FRENCH, SPANISH
TGG	LANGUAGE CONTROL-ENGLISH, ARABIC, FRENCH
TP3	BATTERY-770 CCA & 770 CCA (DUAL)770 CCA & 770 CCA (DUAL)
TR9	LAMP GROUP-
U05	HORN-DUAL
U0F	RADIO-AM/FM STEREO, CAF, RSA, MUSIC NAVIGATOR, GRAPHICS
U0H	RADIO-AM/FM STEREO, USB, GMNA
U19	SPEEDOMETER-INST, KILO & MILES, KILO ODOMETER
U2J	DIGITAL AUDIO SYSTEM-S-BAND - NONE
U2K	DIGITAL AUDIO SYSTEM-S-BAND
U73	ANTENNA-FIXED, RADIO
U80	DISPLAY-COMPASS
UA1	BATTERY-HIGH CAPACITY, WET
UA7	THEFT DETERENT SYS-EXPORT SPECIFIC, VAR #02
UC2	SPEEDOMETER-INST, KILO & MILES, KILO ODOMETER, POSITIVE BIAS

RPO	Description
UD4	ALARM-VEHICLE SPEED, 120 K/H (DON'T USE AFTER 2010 ON NEW MAJORS - USE CTY COD &/OR VCS FAM COD INSTEAD)
UD7	PARK ASSIST-REAR
UE0	COMMUNICATION SYSTEM-VEHICLE - NONE
UE1	COMMUNICATION SYSTEM-VEHICLE, ONSTAR
UEU	SENSOR INDICATOR-FORWARD COLLISION ALERT
UF3	SWITCH-HIGH IDLE
UFA	DISPLAY-OUTSIDE TEMPERATURE
UFL	LANE ACTIVE SAFETY-DEPARTURE WARNING
UFT	SIDE ACTIVE SAFETY-OBSTACLE DETECTION
UJ1	INDICATOR-SYSTEM, BRAKE WARNING
UJM	TIRE PRESS INDICATOR-MANUAL LEARN
UL2	FREQUENCIES-EUROPEAN
UL8	FREQUENCIES-SAUDI ARABIAN
UPF	WIRELESS INTERFACE-SHORT RANGE, VOICE REC
USR	RECEPTACLE-USB
UTJ	THEFT DETERENT-ELECTRICAL, UNAUTHORIZED ENTRY
UTN	PROVISIONS-UPFITTER CONTROL AND MONITORING
UVC	VISION-REAR VIEW, MONO, ANALOG
UXZ	RADIO-PROVISIONS FOR
UY7	WIRING HARNESS-TRUCK TRAILER, HD
V10	PROVISION OPTIONS-COLD WEATHER
V22	GRILLE-RADIATOR, CHROME
V37	BUMPER-FRT & RR, CHROME
V46	BUMPER FRT-CHROME
V4D	CALIBRATION-SEPARATED STOP/TURN SIGNAL CIRCUITS
V78	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - NO CERT STATEMENT (ENGLISH TEXT)
V87	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - GULF STATES ORGANIZATION
V8C	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - NO CERT STATEMENT (SPANISH TEXT)
V8D	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - U.S. FMVSS
V8E	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - CANADA CMVSS
V8I	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - ISRAEL FMVSS
VBX	LANGUAGE LABEL-ARABIC
VC5	LABEL-SHIPPING, EXCEPT US, US POSSESSIONS, OR JAPAN

RPO	Description
VG8	VEHICLE-LABEL, NOTICE TO BUYER
VH6	BUMPER FRT-BLACK
VJG	BUMPER RR-BLACK
VK3	LICENSE PLATE FRONT-FRT MOUNTING PKG
VK5	SEAT-TEMPORARY, FOR SHIPPING
VLU	ACCESSORY-SECURITY SCREEN PACKAGE - REAR WINDOW W/O POP - OUT
VP6	NOISE CONTROL-
VPH	VEHICLE PREPARATION-OVERSEAS DELIVERY
VQK	ACCESSORY-SPLASH GUARDS - CUSTOM MOLDED
VR4	TRAILER HITCH-WEIGHT DISTRIBUTING PLATFORM
VR6	HOOK-TIE-DN SHPG
VT7	OWNERS MANUAL-ENGLISH LANGUAGE
VV4	COMMUNICATION EQUIP-MOBILE INTERNET CONNECTIVITY
VXT	VEHICLE TYPE-INCOMPLETE
VXW	ACCESSORY-ASSIST STEPS - MOLDED
W1Y	CONTROL-STEERING WHEEL, RADIO, REDUNDANT CONTROLS
WEN	PLANT CODE-WENTZVILLE, MO, USA
WMW	VIN MODEL YEAR-2022
X88	MARKET BRAND-CHEVROLET
XHF	TIRE FRONT-LT225/75R16 E 115/112 S BL ALS
XL7	FREQUENCIES RATING-315 MHZ, LONG DISTANCE
XL8	FREQUENCIES RATING-433 MHZ
XLP	TIRE FRONT-LT245/75R16 E 120/116 S BW ALS
Y3H	SALES PACKAGE-HANDICAPPED, MOBILITY, PARATRANSIT
YA2	DOOR SIDE-REAR, SLIDING
YB9	PAINT PROCESS-INTERIOR - NONE
YC6	PACKAGE, CONVENIENCE-DECOR LEVEL #6
YF1	SALES PACKAGE-CUTAWAY UPFITTER
YF2	SALES PACKAGE-AMBULANCE UPFITTER
YF5	CERTIFICATION-EMISSION, CALIFORNIA
YHF	TIRE REAR-LT225/75R16 E 115/112 S BL ALS
YLP	TIRE REAR-LT245/75R16 E 120/116 S BW ALS
Z49	COUNTRY-CANADA
Z82	TRAILER PROVISIONS-SPECIAL EQUIPMENT, H.D.
Z88	MARKET BRAND-GMC
ZHF	TIRE SPARE-LT225/75R16 E 115/112 S BL ALS

RPO	Description
ZLP	TIRE SPARE-LT245/75R16 E 120/116 S BW ALS
ZP0	SEATING ARRANGEMENT-TEMPORARY DRIVER
ZP3	SEATING ARRANGEMENT-15 PASS
ZP6	SEATING ARRANGEMENT-5 PASS CARGO
ZQ2	SALES PACKAGE-DRIVER CONVENIENCE
ZQ3	SALES PACKAGE-DRIVER CONVENIENCE II
ZR7	APPEARANCE PACKAGE-GRILLE & BUMPER CHROME
ZW2	WINDOW PKG-RR DRS
ZW3	WINDOW PKG-RR DRS, SIDE RR DR
ZW4	WINDOW PKG-RH SIDE, RR DRS
ZW6	WINDOW PKG-COMPLETE BODY
ZW9	BODY EQUIPMENT-BASE BODY OR CHASSIS
ZX1	SEATING ARRANGEMENT-DRIVER ONLY, HIGH BACK
ZX2	SEATING ARRANGEMENT-DRIVER & PASS, HIGH BACK
ZX5	SEATING ARRANGEMENT-12 PASS
ZX9	TIRE SPARE-W/WHEEL - NONE
ZY1	COLOR COMBINATION-SOLID

BLANK

Section 2

Body Systems

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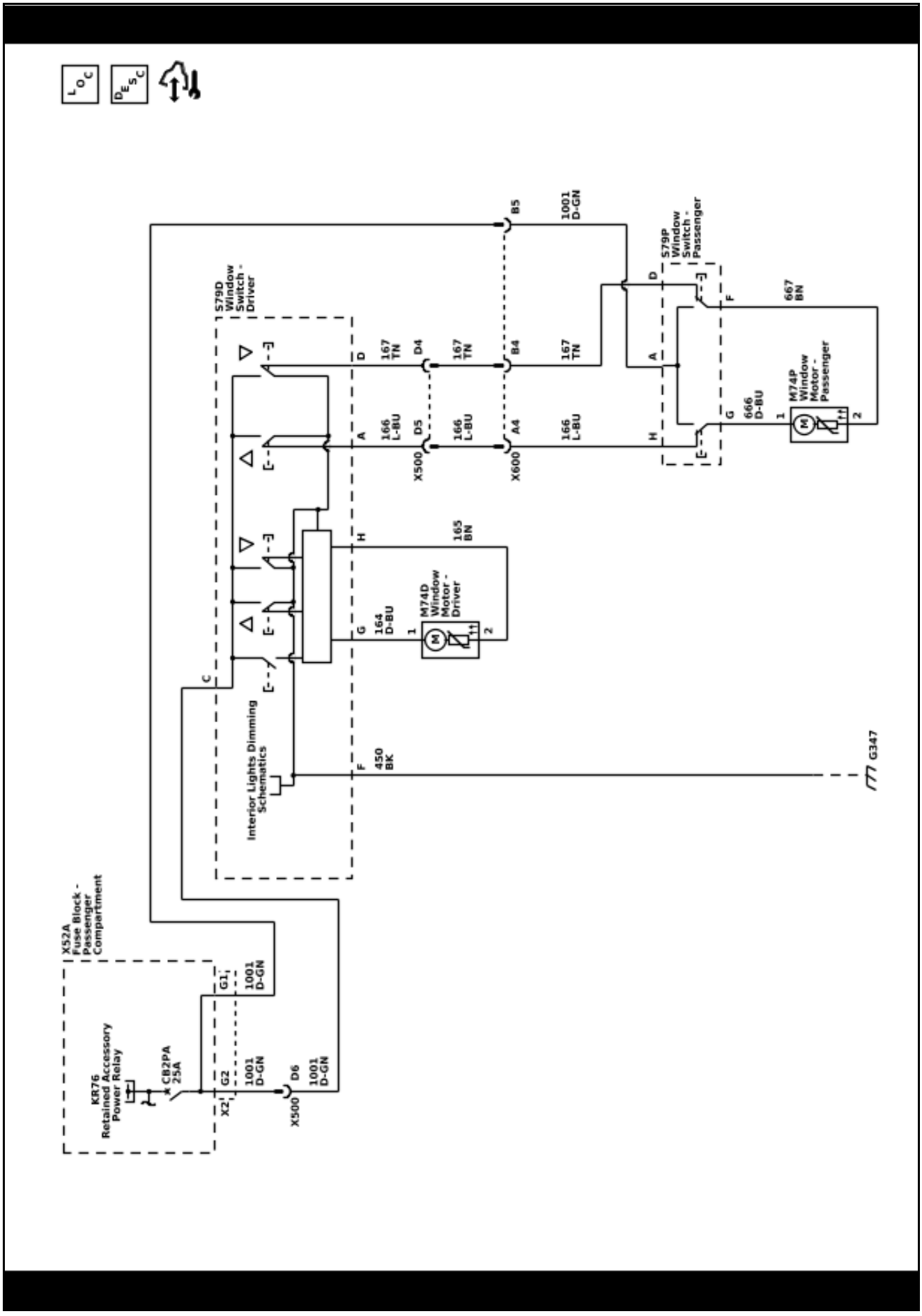
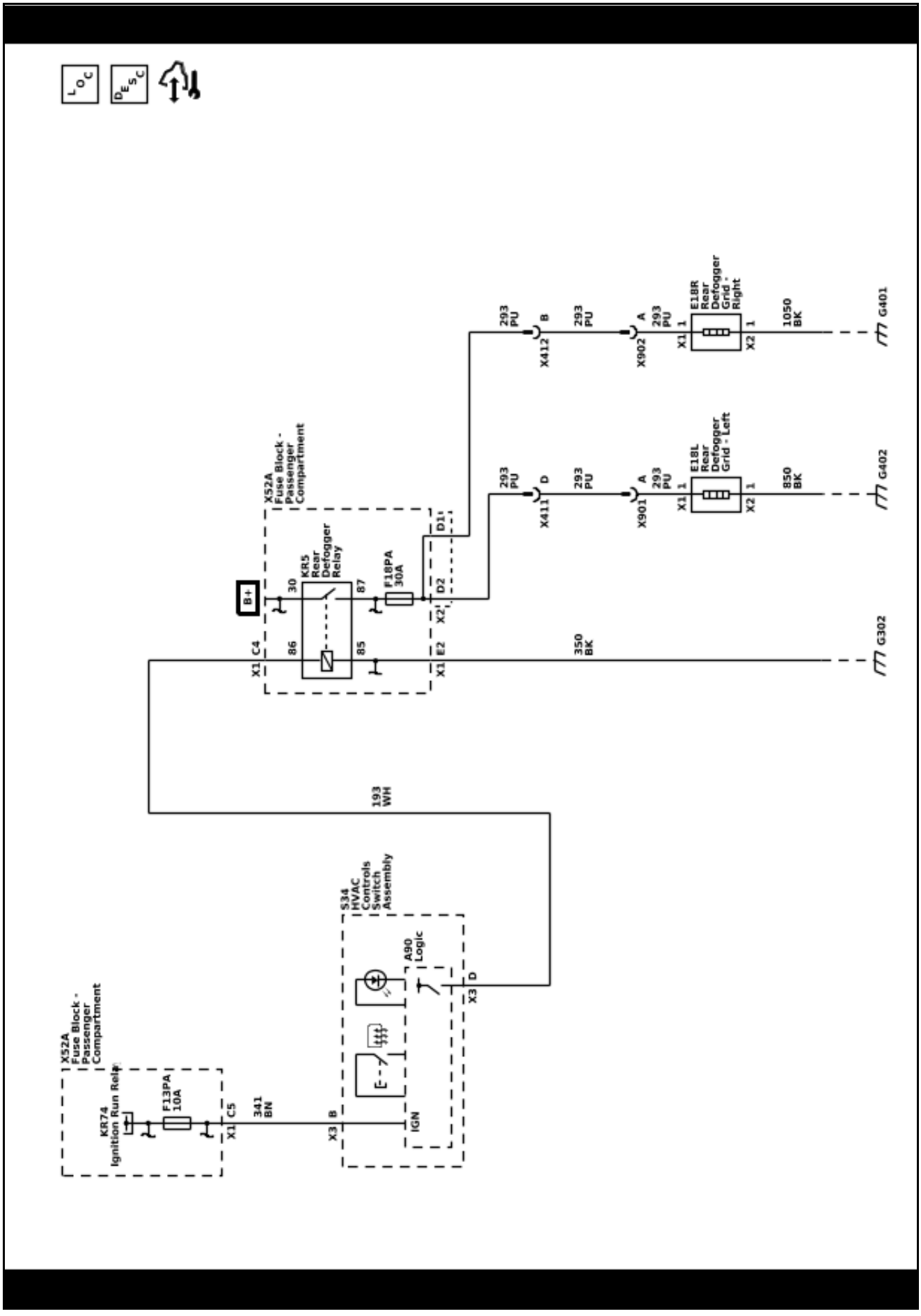
Fixed and Moveable Windows

Schematic and Routing Diagrams

Moveable Window Schematics (Moveable Windows (A31))



Defogger Schematics (Defogger (C49))



Description and Operation

Power Windows Description and Operation

Power Window System Components

The power window system consists of the following components:

- LF power window master switch
- RF power window switch
- Reversible power window motors in each of the doors (circuit breaker protected)
- PWR WNDW 25A circuit breaker

Power Window System Controls

The power window system will operate anytime the ignition switch is in the ACCY or ON position or when RAP is activated.

The LF power window master switch can control the up and down functions of both the windows in the vehicle. The passenger door power window switch can only control the up and down functions of the passenger window.

Power Window Motor Operation

A permanent magnet motor operates each of the power side windows. Each motor raises or lowers the glass when the motor receives voltage. The direction the motor turns depends on the polarity of the supply voltage. The power window switches control the polarity of the supply voltage. A built-in circuit breaker protects each motor. The circuit breaker opens when the switch is depressed for a extended period of time under the following conditions:

- The window has an obstruction.
- The window is fully open or fully closed.

The circuit breaker will reset automatically as the circuit breaker cools.

Power Window Operation

The normally closed contacts of the switch are connected to ground and the center pole is connected to the accessory voltage circuit. By placing the left power window switch in the down position, voltage is applied to the power window motor left front down circuit and to the power window motor. The other side of the power window motor is connected to ground through the normally closed contacts of the left power window switch through the power window motor left front up circuit and drives the window down.

By placing the power window switch in the up position the polarity of the motor is reversed and the motor drives the window up.

Rear Window Defogger Description and Operation

Rear Window Defogger System Components

The rear window defogger system consists of the following components:

- HVAC control assembly
- Rear window defogger relay
- Rear window defogger grid

Rear Window Defogger Operation

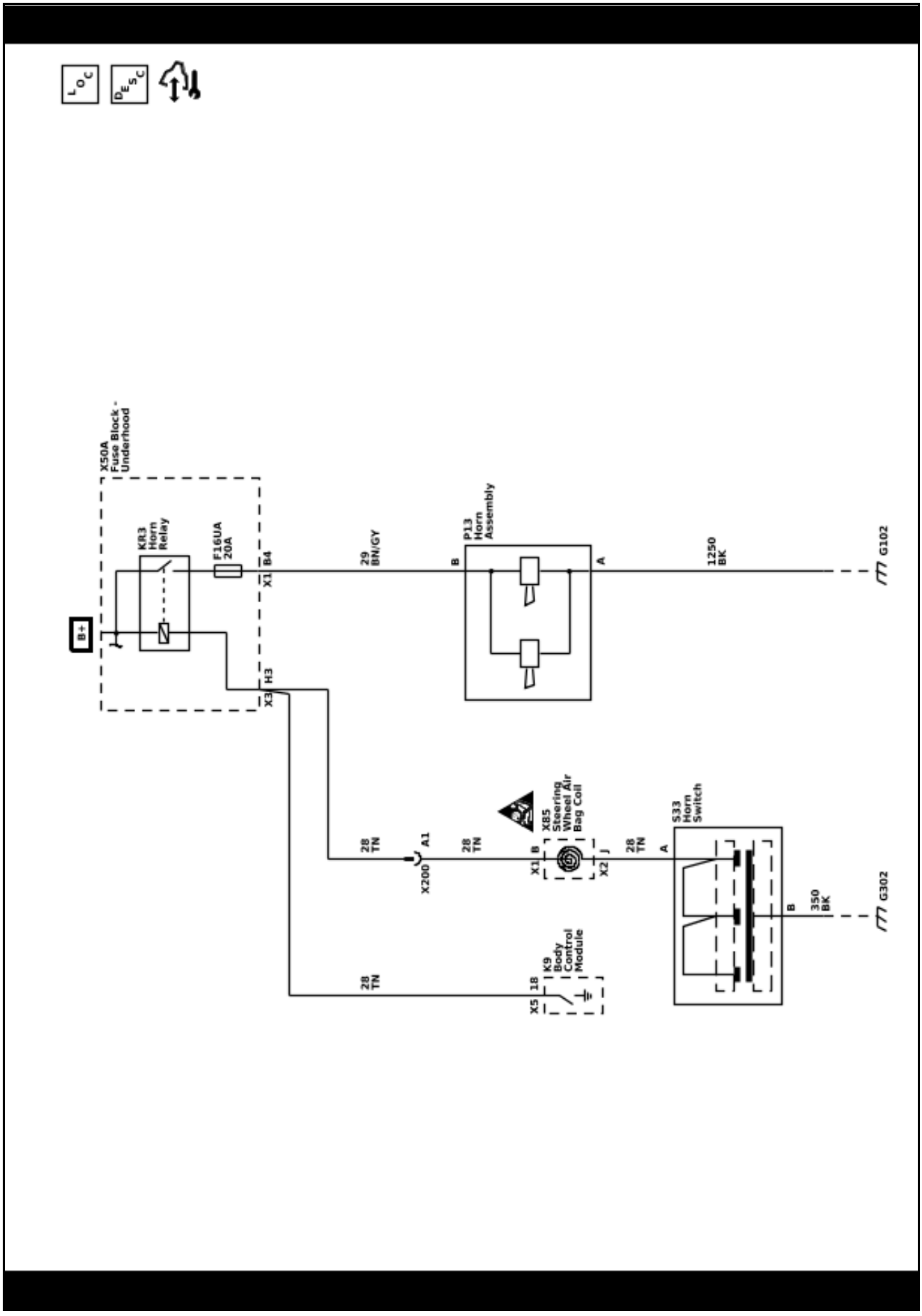
When you turn the ignition to the ON position, battery positive voltage is supplied through the HTD MIR DEFOG fuse to the rear window defogger relay switched input. Ground is for the rear window defogger relay coil is provided by G302. Battery positive voltage and ignition voltage is supplied to the HVAC control assembly for rear window defogger operation. When the rear window defogger switch is depressed, the HVAC control assembly energizes the rear window defogger relay by supplying battery positive voltage to the rear window defogger relay coil. This allows battery positive voltage from the relay switched input through the switch contacts and out the relay switched output to the rear window defogger grids. The HVAC control assembly also illuminates the rear window defogger indicator upon this request. Ground for the left rear window defogger grid is provided by G401. Ground for the right rear window defogger grid is provided by G402.

When you turn ON the ignition and press the rear window defogger switch for the first time, the defogger cycle lasts 10 minutes. Further operation results in 5 minute defogger cycles. The defogger cycle resets to 10 minutes when you cycle the ignition to the OFF position and then back to the ON position.

Horns and Pedestrian Alerts

Schematic and Routing Diagrams

Horn Schematics (Horn Schematics)



Description and Operation

Horns System Description and Operation

System Description

The horn system consists of the following components:

- The HORN fuse
- The Horn relay
- The Horn Contact
- The Horn Assembly
- Body Control Module (BCM)

System Operation

- The vehicle horns are activated whenever the horn switch is depressed.
- The BCM commands the horns ON under any of the following conditions:
  - When the panic button is depressed on the remote control door lock transmitter. For further information refer to *Keyless Entry System Description and Operation on page 7-9*.
  - When the keyless entry system is used to lock the vehicle, a horn chirp may sound to notify the driver that the vehicle has been locked. The notification feature may be enabled or disabled through personalization. For further information refer to *Keyless Entry System Description and Operation on page 7-9*.

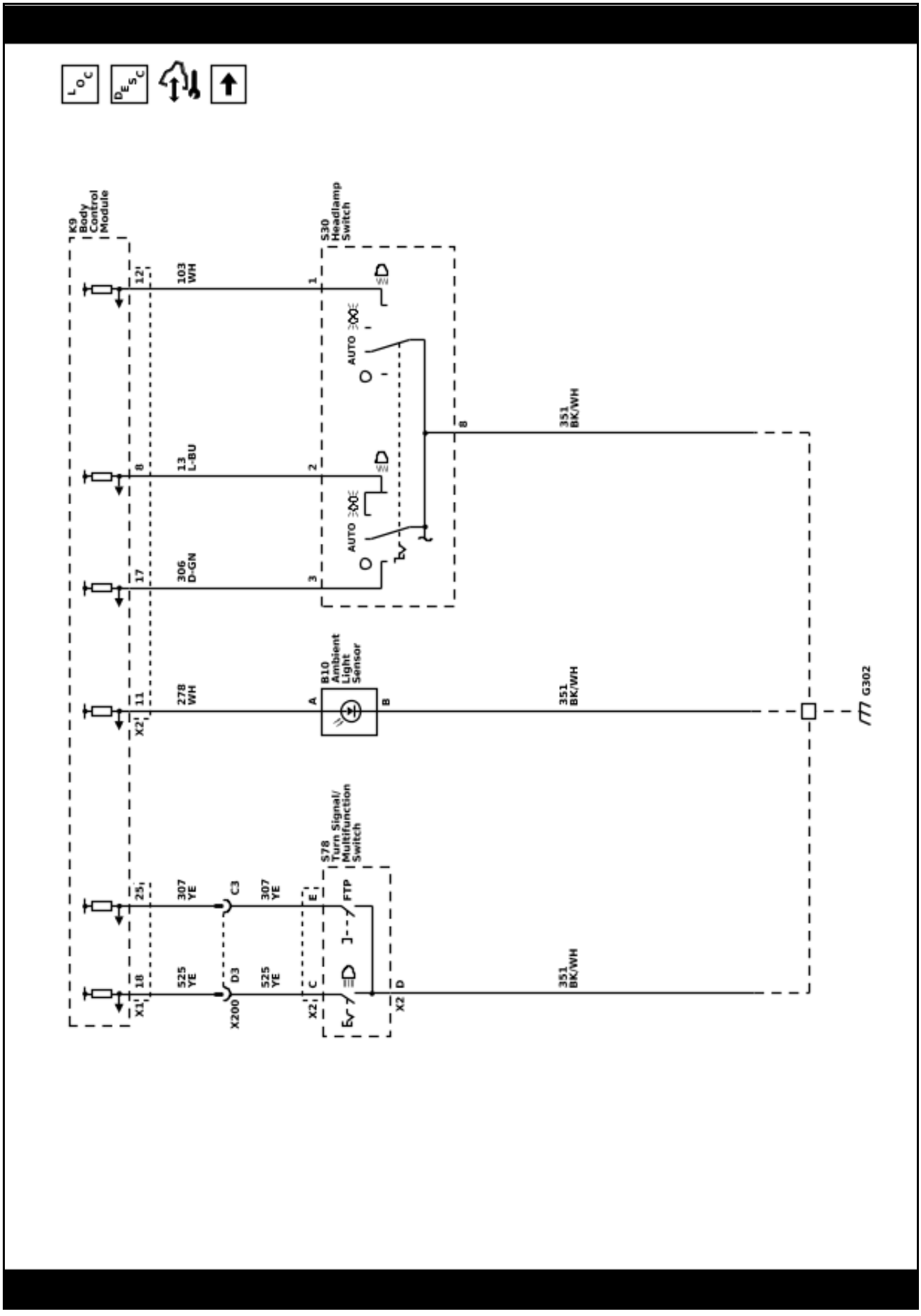
Circuit Operation

Battery positive voltage is applied at all times to the horn relay coil and the horn relay switch. Pressing the horn switch applies ground to the horn relay control circuit. When the horn relay control circuit is grounded, the horn relay is energized and battery positive voltage is applied to the horns through the horn control circuit. The horns sound as long as ground is applied to the horn relay control circuit.

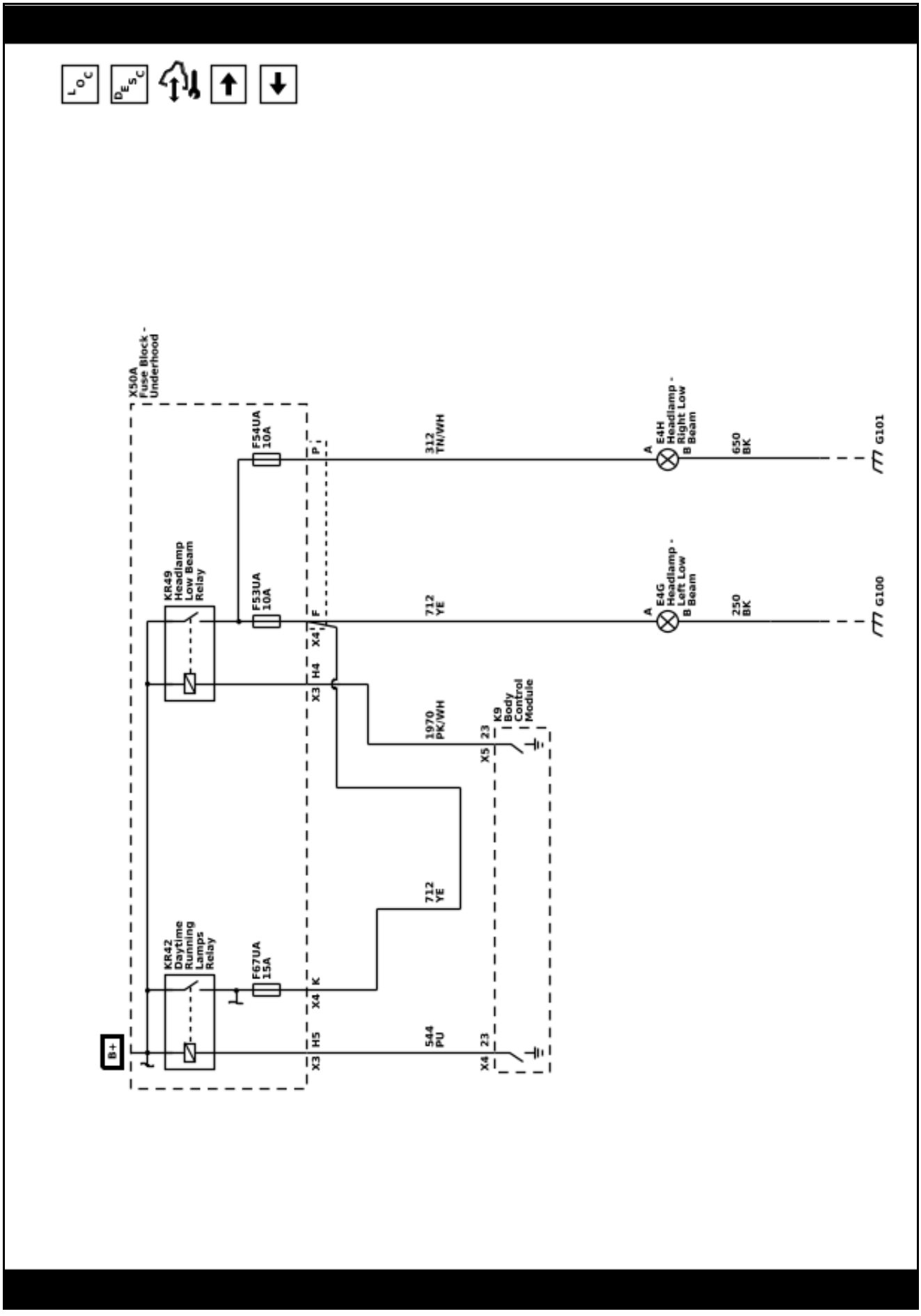
Lighting

Schematic and Routing Diagrams

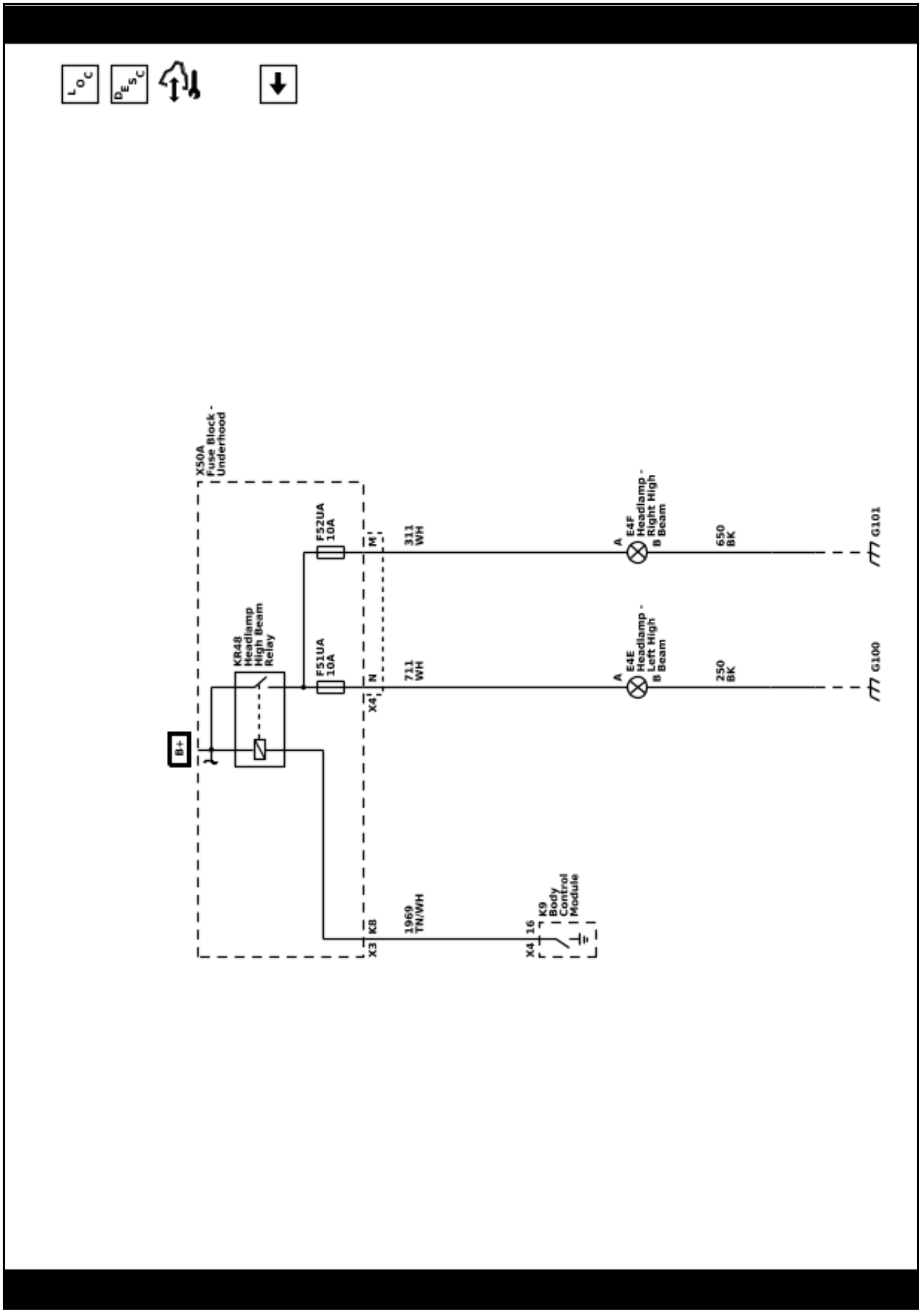
Headlights/Daytime Running Lights (DRL) Schematics (Headlamp and Daytime Running Lamp Controls)



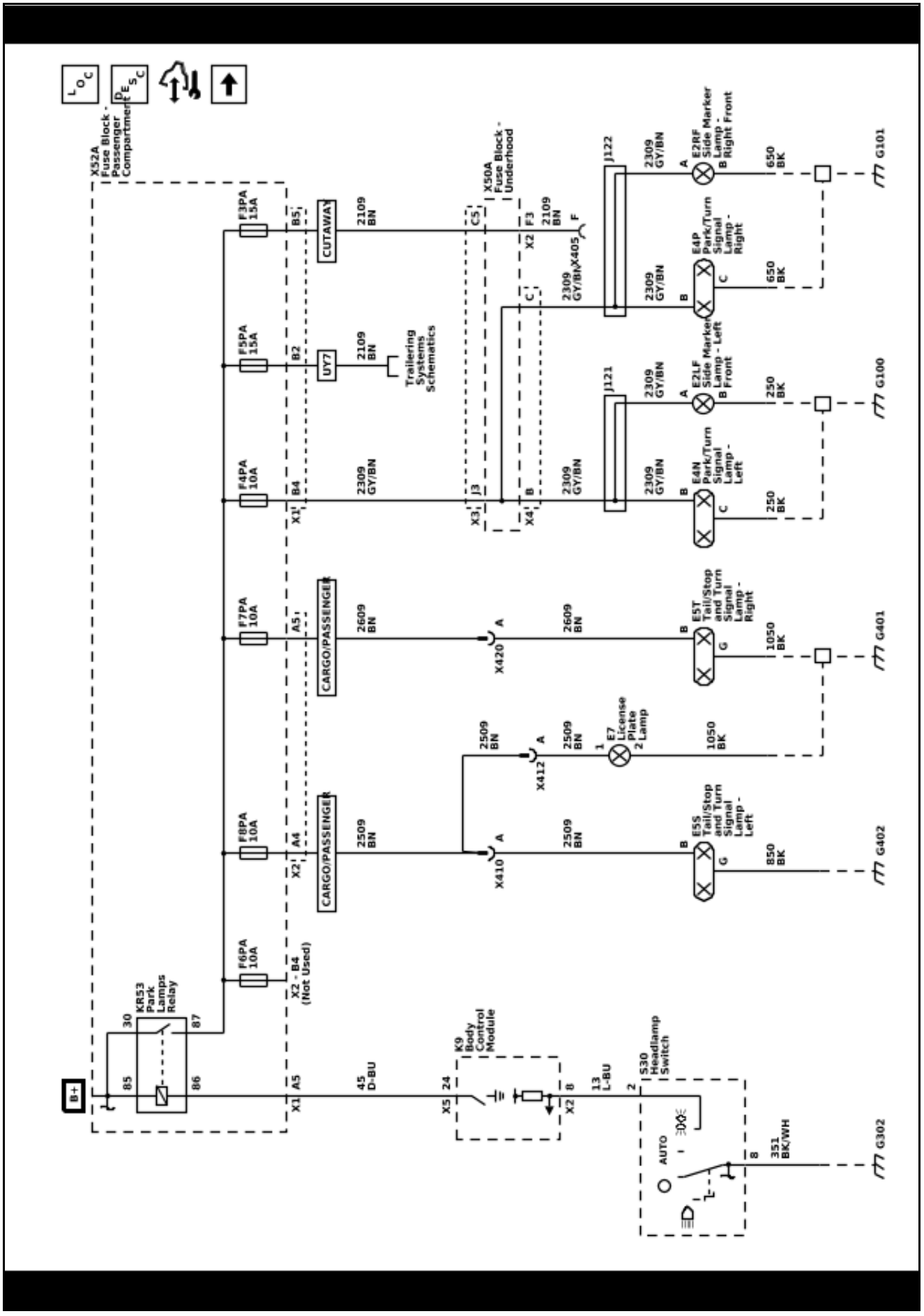
Headlights/Daytime Running Lights (DRL) Schematics (Low Beam and Daytime Running Lights (DRL))



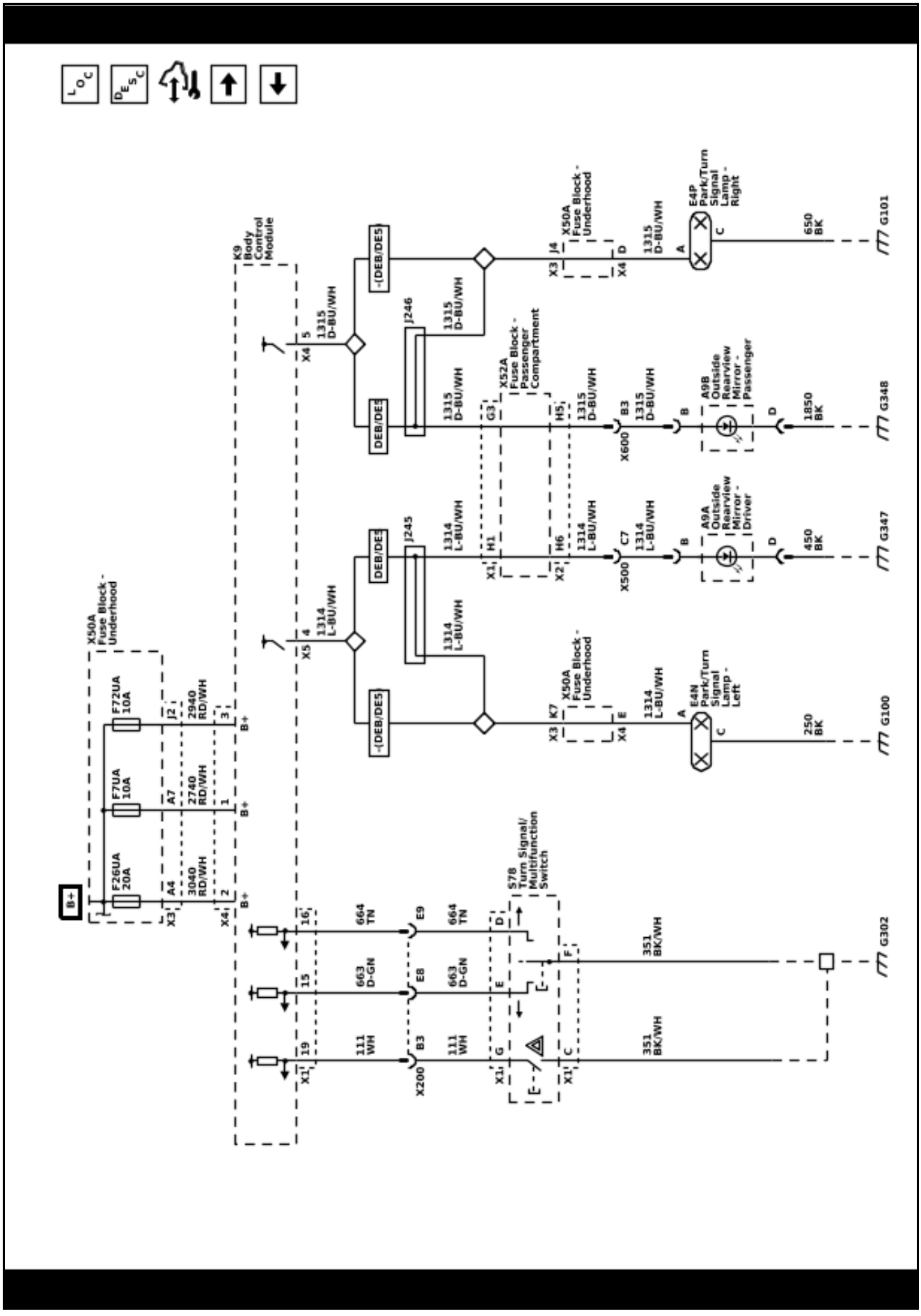
Headlights/Daytime Running Lights (DRL) Schematics (High Beams)



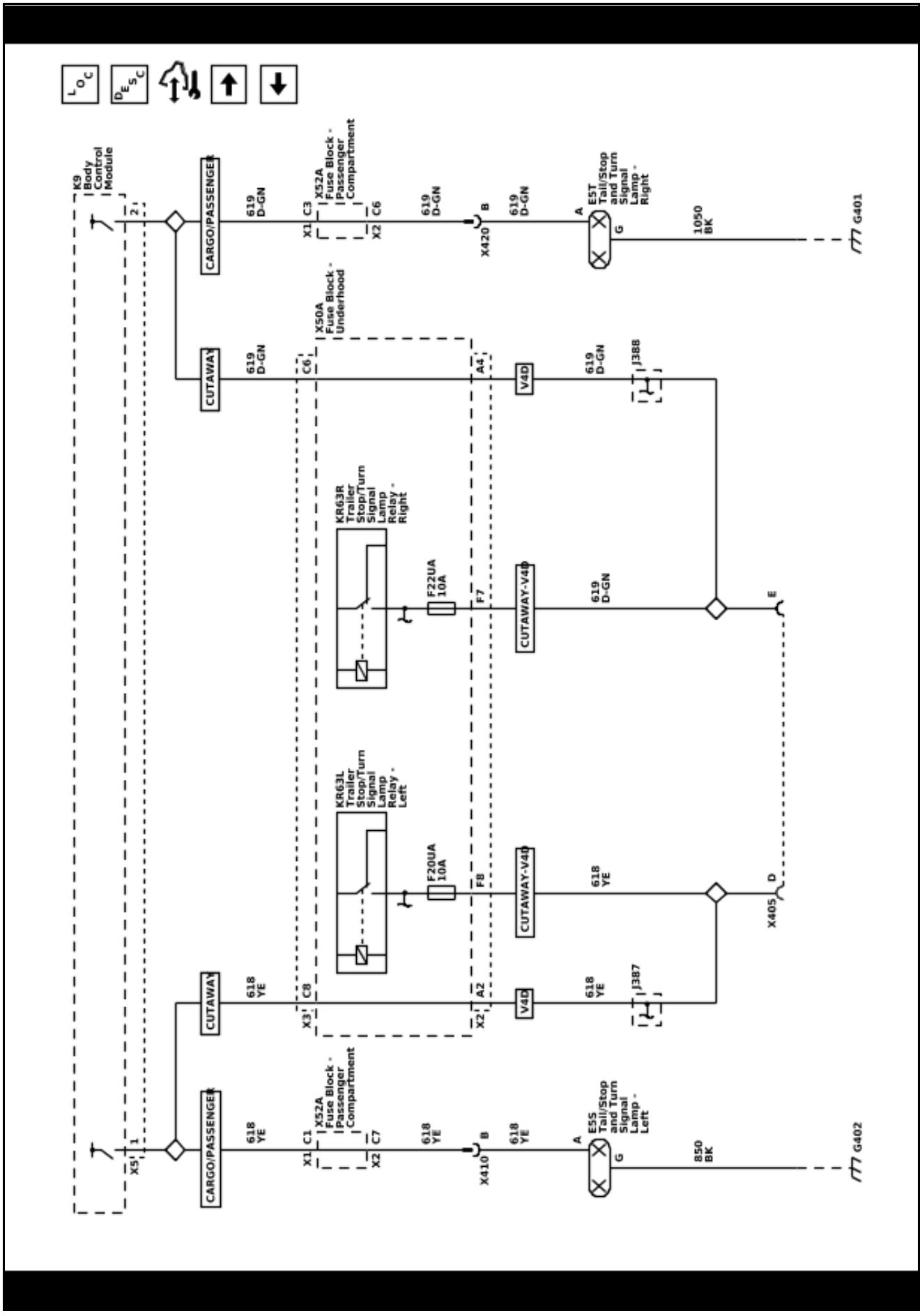
Exterior Lights Schematics (Park Lamp Controls and Park Lamps)



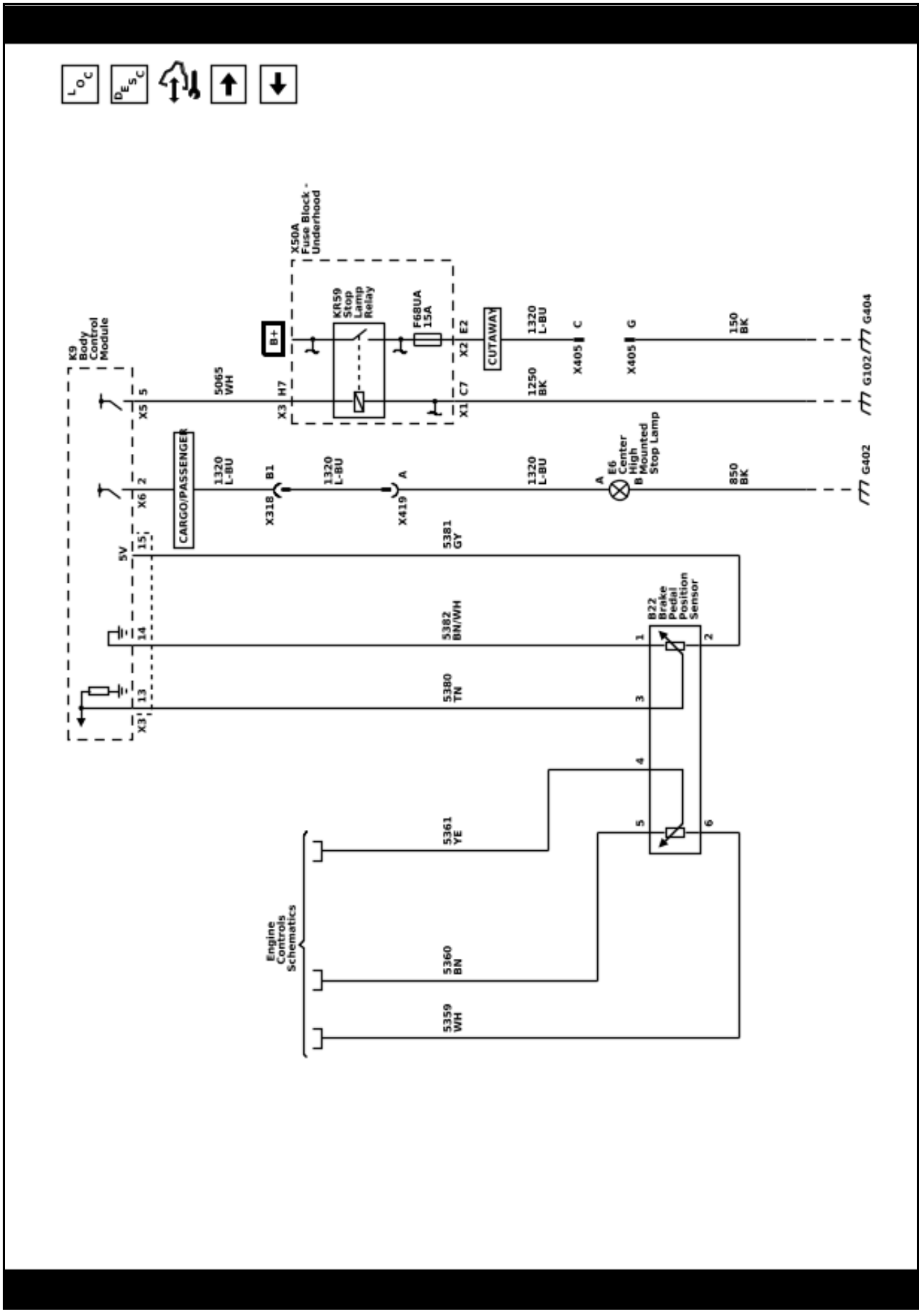
Exterior Lights Schematics (Turn Signal Controls and Front Turn Signal Lamps)



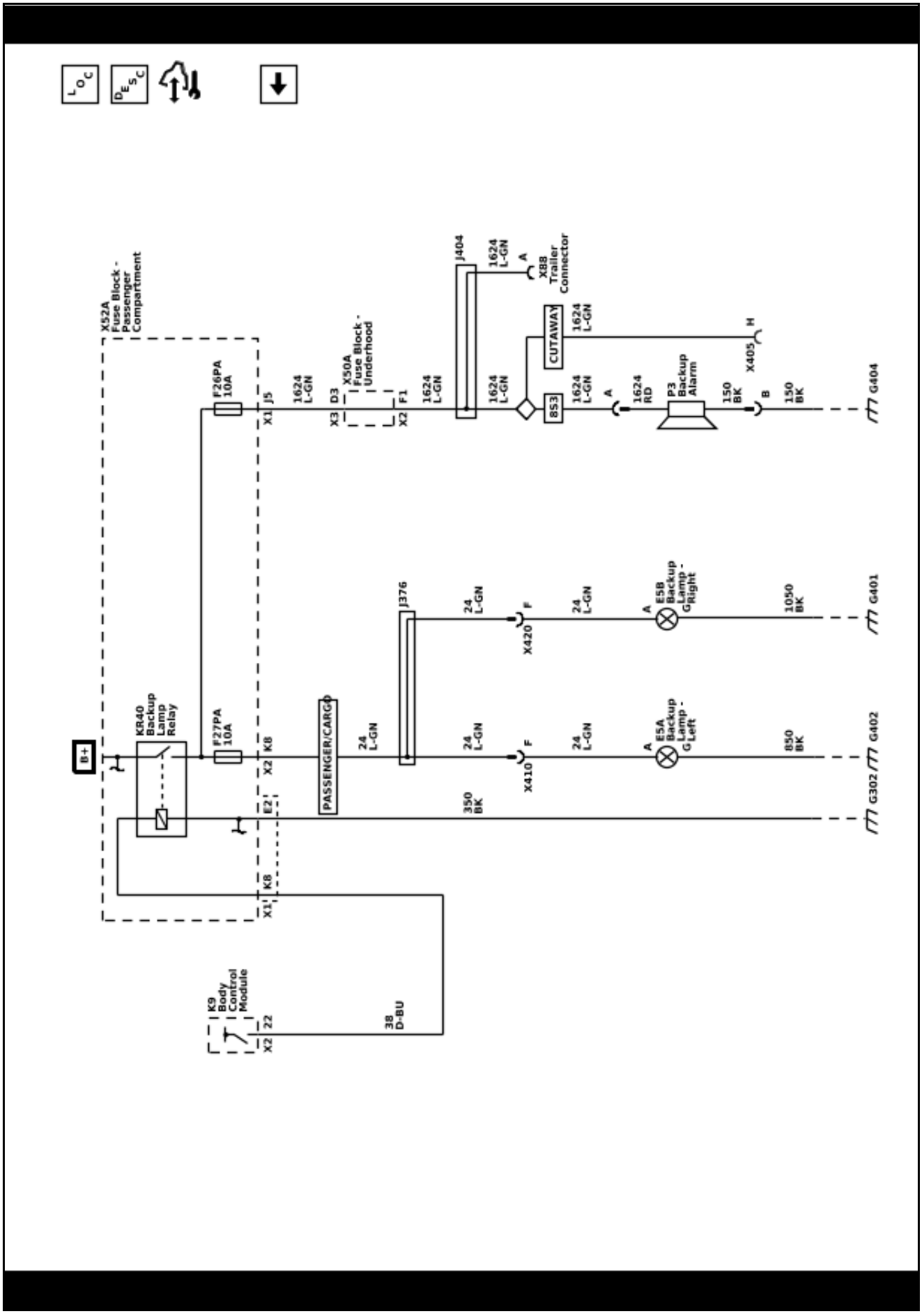
Exterior Lights Schematics (Rear Turn Signal Lamps)



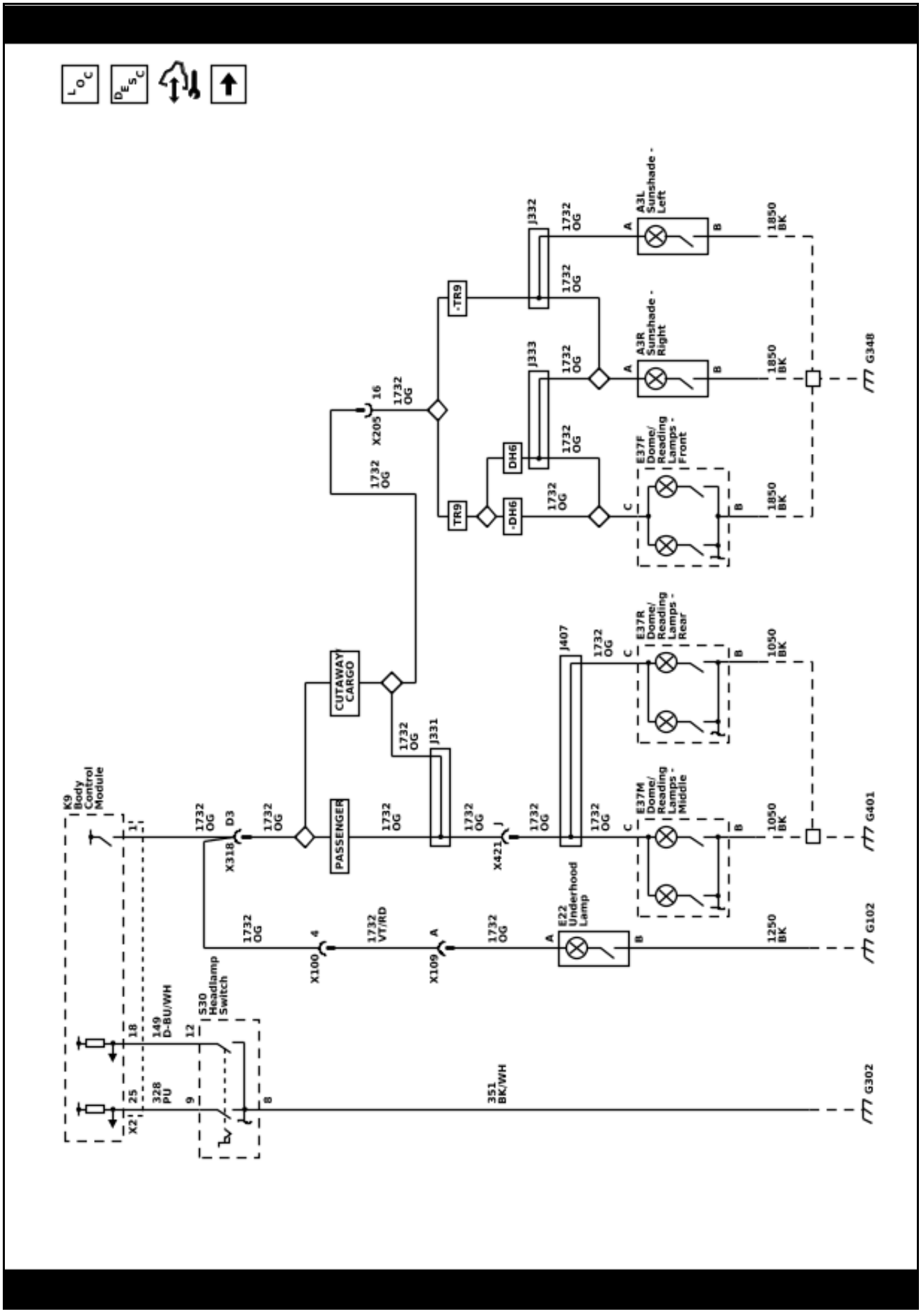
Exterior Lights Schematics (Stop Lamp Controls and CHMSL)



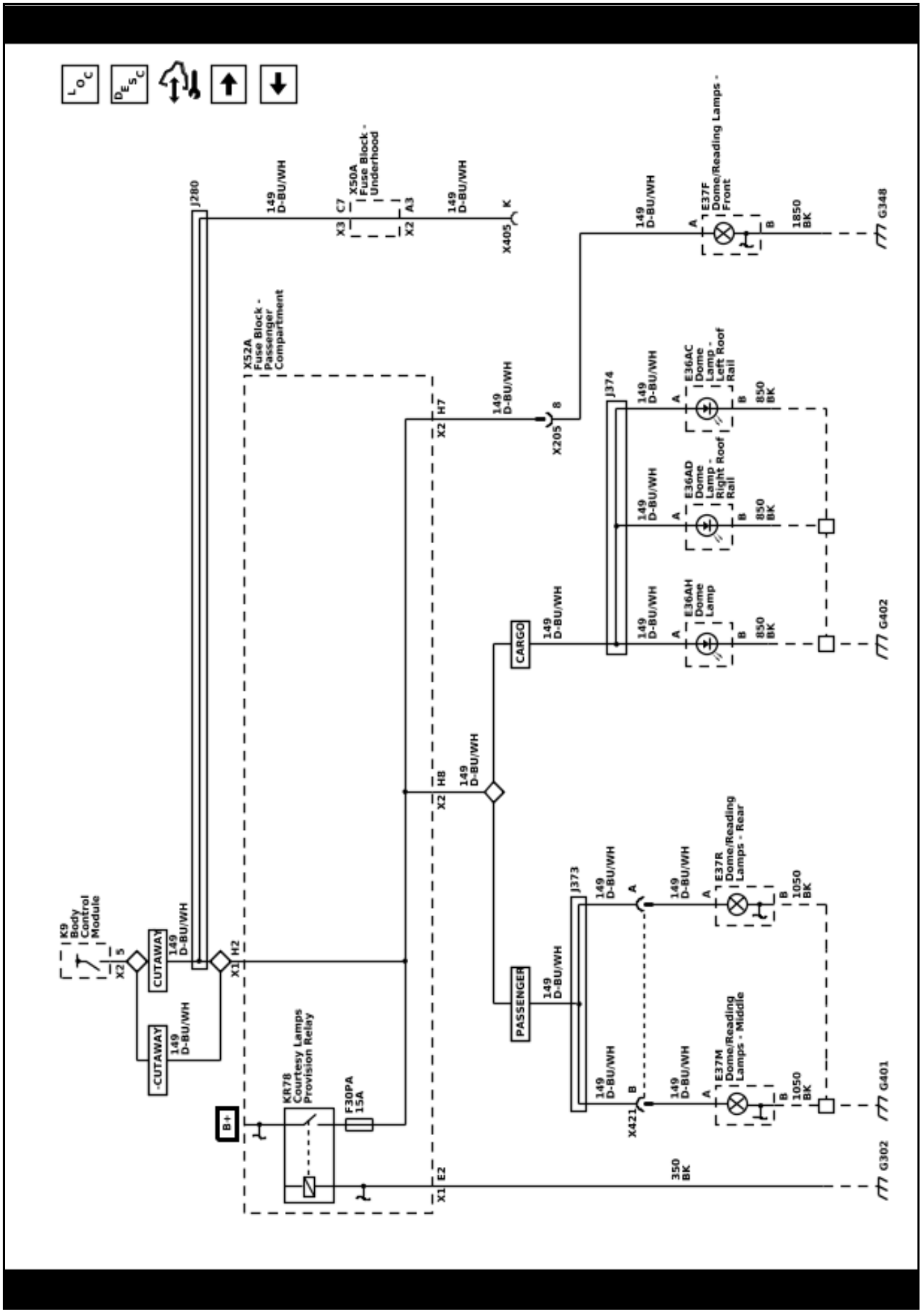
Exterior Lights Schematics (Backup Lamps and Backup Alarm)



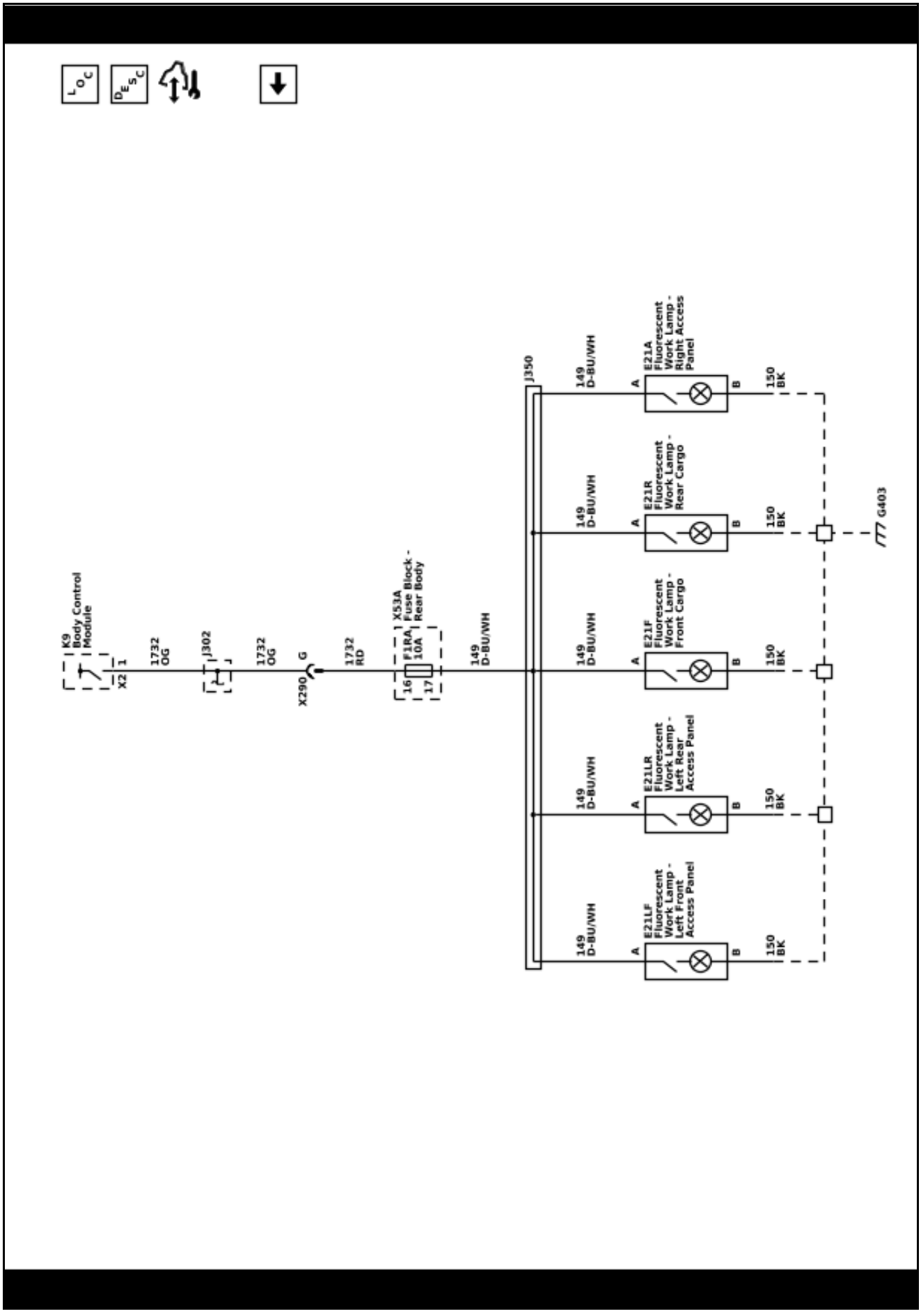
Interior Lights Schematics (Inadvertent Lamp Control)



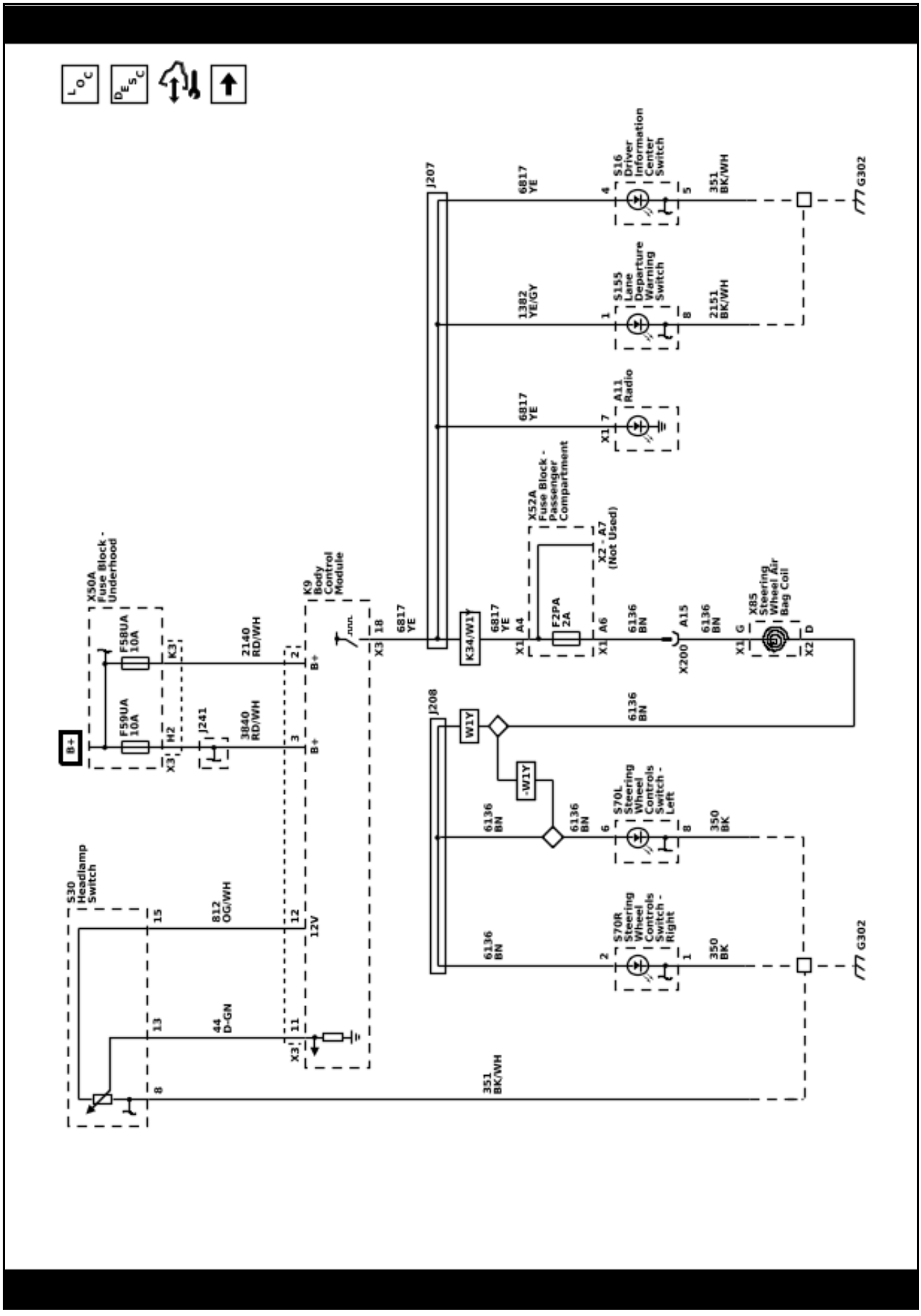
Interior Lights Schematics (Courtesy Lamp Control)



Interior Lights Schematics (Side Access Panel and Cargo Work Lamps (PRP with UF2))



Interior Lights Dimming Schematics (Dimming Controls and LED Dimming)



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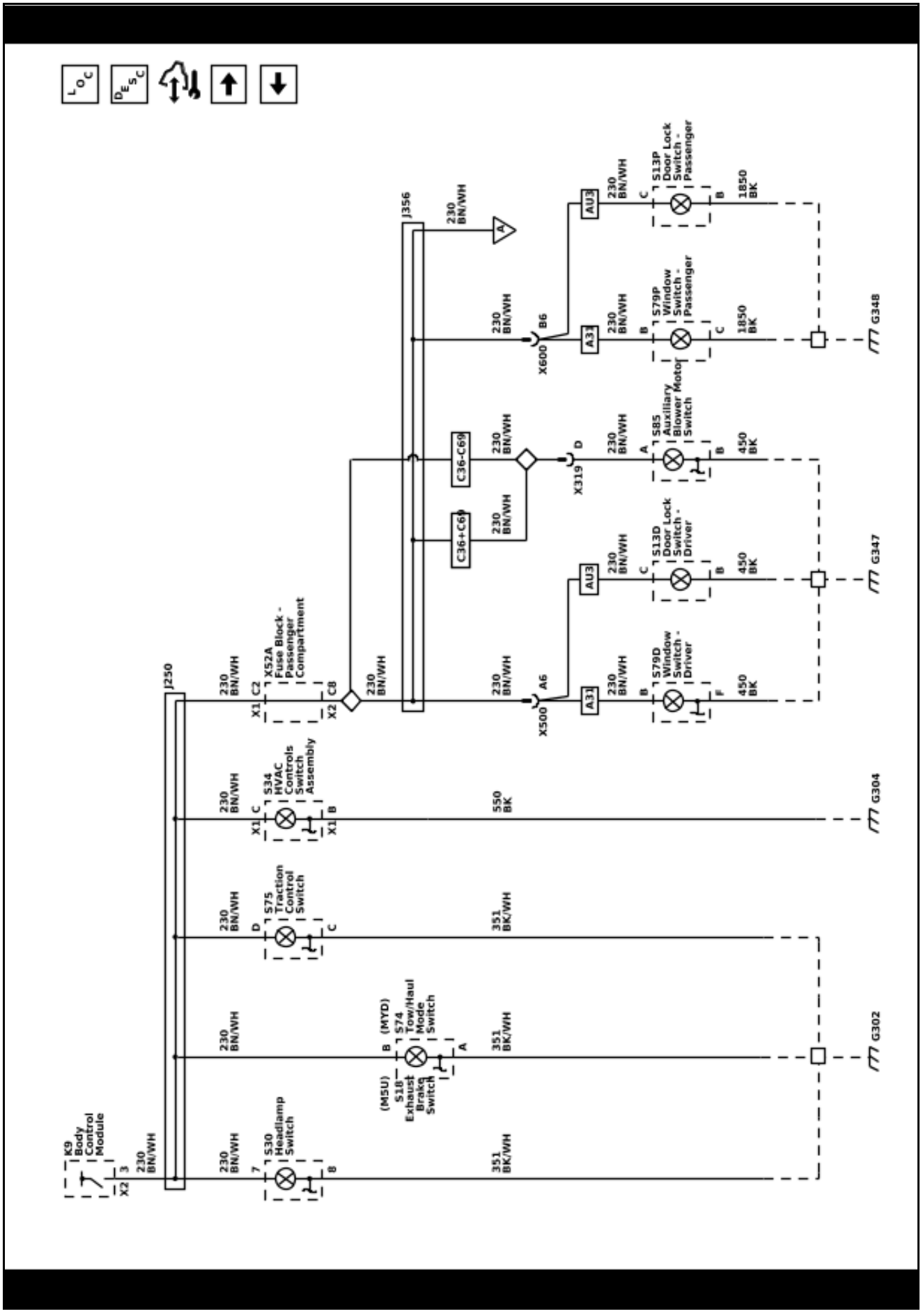
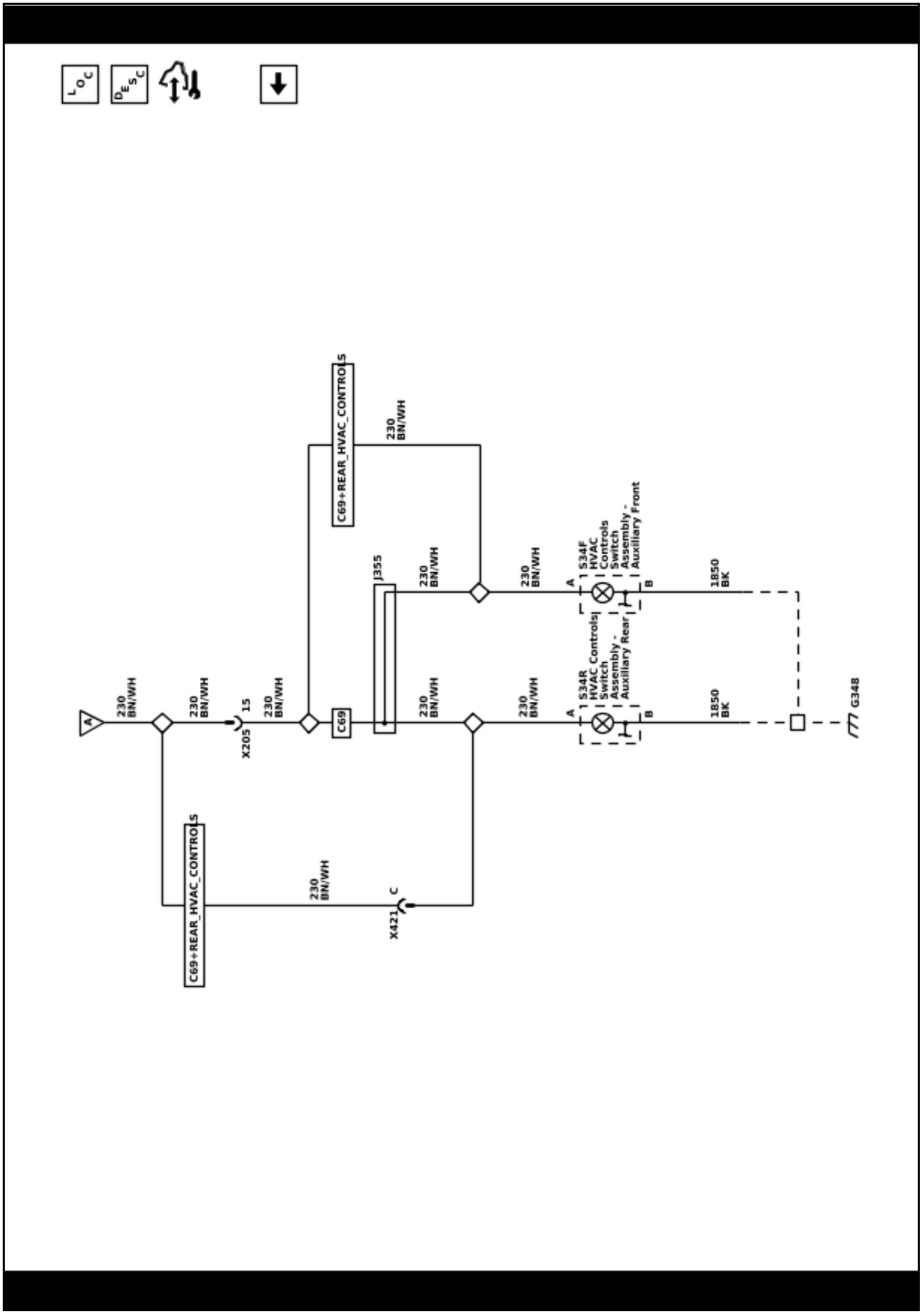
Interior Lights Dimming Schematics (I/P Bulb Dimming (1 of 2))



Interior Lights Dimming Schematics (I/P Bulb Dimming (2 of 2))



Description and Operation
Exterior Lighting Systems Description and Operation

Exterior Lamps

The exterior lighting consist of the following lamps:

- Headlamps
- Daytime running lamps (DRL)
- Park lamps
- Tail lamps
- License lamps
- Marker lamps
- Turn signal lamps
- Stop lamps
- Center high mounted stop lamp (CHMSL)
- Backup lamps

Low Beam Headlamp Operation

The headlamps may be turned ON in 3 different ways:

- When the headlamp switch in the HEAD position for normal operations
- When the headlamp switch is in the AUTO position, for automatic lamp control (ALC)
- When the headlamp switch is placed in the AUTO position, with the windshield wipers ON in daylight conditions, after a 6 second delay

Battery voltage is applied at all times to the coil and switch sides of the LOW BEAM PCB Relay located in the underhood fuse block. With the headlamp switch in the headlamps ON position, ground is applied through the headlamps ON switch signal circuit to the body control module (BCM) signaling the headlamps ON request. In response to this signal, the BCM applies ground through the low beam relay control circuit energizing the LOW BEAM PCB Relay. With the relay energized, battery voltage is applied through the switch side of the relay, the LT and RT LOW BEAM fuses, and the low beam supply voltage circuits illuminating the low beam headlamps.

High Beam Headlamp Operation

Battery voltage is applied at all times to the coil and switch sides of the HIGH BEAM PCB Relay located in the underhood fuse block. When the headlamp dimmer switch is placed in the high beam position, the headlamp dimmer switch signal circuit to the BCM is pulled low signaling the headlamp high beam request. In response to this signal, the BCM applies ground through the high beam relay control circuit energizing the high beam relay. With the relay energized, battery voltage is applied through the switch side of the relay, the LT and RT HIGH BEAM fuses, and the high beam supply voltage circuits illuminating the high beam headlamps. At the same time the BCM sends a serial data message to the instrument panel cluster (IPC) requesting the IPC to illuminate the high beam indicator.

Flash to Pass (FTP)

When the headlamp dimmer switch is pulled toward the driver, the flash to pass signal circuit to the BCM is pulled low signaling the flash to pass request. The BCM then turns ON the high beam headlamps as described above until the headlamp dimmer switch is released. If the low beam headlamps were ON during FTP operation they will remain ON.

Daytime Running Lamps (DRL) and Automatic Lamp Control (ALC)

The low beam headlamps are used for DRL operation at a reduced intensity. The DRLs will operate only with the ignition ON, the headlamp switch in the AUTO position, and the gear selector out of the park position. No other exterior lamps such as the parking lamps, tail lamps, etc. will be on when the DRL are being used. The instrument panel will not be illuminated either.

DRL operation is determined by the ambient light sensor and controlled by the body control module (BCM). The ambient light sensor is a light-sensitive transistor used to monitor outside lighting conditions. The BCM provides a 5-volt reference signal to the sensor. The sensor will vary this voltage signal between 0.2 and 4.9 volts depending on outside lighting conditions. The BCM monitors the ambient light sensor signal circuit to determine if outside lighting conditions are correct for either DRL or ALC operation. When the BCM determines the conditions are met for DRL operation, it applies ground to the DRL relay control circuit energizing the DRL PCB Relay. With the relay energized, battery voltage is applied through the switch side of the relay, the DRL 1 fuse, the DRL 2 fuse, both low beam headlamp fuses, and the low beam supply voltage circuits illuminating the headlamps at a reduced intensity. Any function or condition that turns on the headlamps will cancel DRL operation.

When the BCM detects low light conditions, it will turn OFF the daytime running lamps and turn ON the low beam headlamps as described above in Low Beam Headlamp Operation. The BCM will also turn ON the low beam headlamps in daylight conditions when the windshield wipers are turned ON.

HDLPS Suggested Indicator

If the park lamps are turned ON manually and the ambient light sensor detects a low light condition then the body control module (BCM) will send a message to the instrument panel cluster (IPC) to display the HEADLAMPS SUGGESTED message.

Lights ON Warning

The body control module (BCM) activates the lights ON warning as requested by the headlamp dimmer switch. The lights ON warning sounds when the following occurs:

- The key is out of the ignition.
- The BCM determines that the drivers door is open, signal is low.
- The BCM determines that the headlamp switch is in the PARK or HEAD position.

Park, Tail, Marker and License Lamps

The park, tail, and marker lamps are turned ON when the headlamp switch is placed in either the HEAD or PARK lamp positions, or anytime the automatic light control (ALC) turns the headlamps ON. When the headlamp switch is placed in the park lamp or headlamp positions, ground is applied through the switch signal circuit to the BCM indicating the park lamp ON request. In response to this signal, the BCM applies ground through the park lamp relay control circuit energizing the PRK LAMP Relay. With the relay energized, battery voltage is applied through the switch side of the relay, the park lamp fuses, and the supply voltage circuits illuminating the park, license, side marker, and tail lamps.

Turn Signal Lamps

The BCM 3, BCM 5, and BCM 6 fuses located in the underhood fuse block supply battery voltage to the body control module (BCM) for turn signal, hazard lamp, and stop lamp operation. Voltage from the BCM 5 fuse used for the front and rear left turn signals, voltage from the BCM 3 for the right front turn signal, while voltage from the BCM 6 fuse is used for the right rear turn signal. When the turn signal switch is place in either the LEFT or RIGHT position, ground is applied through the turn signal switch signal circuit to the BCM indicating the turn signal request. In response to this signal, the BCM applies a pulsating voltage to the front and rear turn signal lamps supply voltage circuits cycling the lamps ON and OFF. The BCM also sends a message via to the instrument panel cluster (IPC) to cycle the turn signal indicator ON and OFF depending on the position of the turn signal switch.

Hazard Lamps

The hazard flashers may be activated in any power mode. When the hazard lamp switch is placed in the ON position, ground is applied through the hazard switch signal circuit to the body control module (BCM) indicating the hazard lamps ON request. In response to this signal, the BCM applies a pulsating voltage though all front and rear turn signal supply voltage circuits cycling the lamps ON and OFF. The BCM also sends a serial data message to the instrument panel cluster (IPC) to cycle both turn signal indicators ON and OFF.

Stop Lamps (cargo/passenger)

The brake pedal position sensor is used to sense the action of the driver application of the brake pedal. The brake pedal position sensor provides an analog voltage signal that will increase as the brake pedal is applied. The body control module (BCM) provides a low reference signal and a 5-volt reference voltage to the brake pedal position sensor. When the variable signal reaches a voltage threshold indicating the brakes have been applied, the BCM will apply battery voltage to the right and left stop lamp control circuits, transmission control module (TCM), engine control module (ECM), center high mounted stop lamp (CHMSL) control circuit, and trailer brake control module if equipped.

Stop Lamps (cutaway)

The BCM controls the stop lamps based on the input from the stop lamp switch. When the BCM detects the brake pedal is depressed, B+ is applied to the stop lamp relay control circuit energizing the Stop Lamp PCB Relay. With the relay energized, B+ is applied to the stop/turn lamp supply voltage circuits illuminating both stop lamps.

Backup Lamps

When the gear selector is placed in the REVERSE position, the powertrain control module (PCM) sends a serial data message to the BCM indicating the backup lamps ON request. The BCM then applies battery voltage through the backup relay control circuit energizing the BCK/UP LAMP PCB Relay. With the relay energized, battery voltage is applied through the switch side of the relay, the T/LAMP BCK/UP fuse, the AUX/TRLR BCK/UP fuse and the supply voltage circuits illuminating the left and right backup lamps and the backup alarm. The engine may need to be running for the backup lamps to function.

Rear Fog Lamps

The rear fog lamps are located in the rear bumper. The fog lamps will operate only when the ignition in the RUN or CRANK positions. When the rear fog lamp switch is turned ON, ground is applied through the rear fog lamp switch signal circuit to the body control module (BCM) indicating the rear fog lamps ON request. In response to this signal, the BCM applies ground to the rear fog lamp relay control circuit energizing the REAR FOG LP PCB Relay. With the relay energized, battery voltage is applied through the switch side of the relay, the RR FOG LP fuse and the rear fog lamp supply voltage circuit to the left and right rear fog lamps. The BCM sends a serial data message to the instrument panel cluster (IPC) requesting the rear fog lamp indicator be illuminated. The rear fog lamps will deactivate if the headlamps are turned OFF, if the ignition is turned to the OFF position upon a key cycle, or if the driver turns the rear fog lamp switch OFF.

Battery Rundown Protection/ Inadvertent Power

The BCM controls the lighting system through circuits that enable the exterior lamp functions of the park lamps, the head lamps, the fog lamps, and the interior lamps. The BCM will open these enabling circuits 10 minutes after the ignition switch is turned OFF with no lamp switch activity. If the ignition switch is turned to any position other than OFF, or if a lamp switch is activated during this time period, the timer will reset for another 10 minutes.

Interior Lighting Systems Description and Operation

The interior lighting consist of two groups; lamps that may not be manually dimmed (Interior Lamps) and lamps that may be dimmed (Interior Lamps Dimming).

The first group listed below includes lamps that may not be dimmed:

- Front dome/reading lamps
- Middle dome/reading lamps
- Rear dome/reading lamps
- Sunshade Mirror Lamps
- Underhood Lamp

Interior Lamps Features

The interior lamps system features the following functions:

- An illuminated entry feature that illuminates the courtesy lamps when entering the vehicle or activating the remote keyless entry system.
- An illuminated exit feature that illuminates the courtesy lamps when the ignition key has been removed from the ignition.
- An inadvertent power feature that supplies voltage to all interior lamps after the ignition is turned OFF. The inadvertent power feature will deactivate all interior lamps after 10 minutes to prevent battery rundown.
- A theater dimming feature that will slowly dim the interior lamps from full brightness to OFF.
- Individual switches for control of each interior lamp that is not illuminate with the interior lamp switch.

Courtesy Lamps (−YF2/YF7)

When any one of the doors is opened, ground is applied through the door latch door open switch and the door open switch signal circuit to the BCM indicting the door open position. In response to this signal, the BCM then applies battery voltage through the courtesy lamp supply voltage circuits illuminating the courtesy lamps.

Courtesy Lamps (+YF2/YF7)

When any one of the doors is opened, ground is applied through the door latch door open switch and the door open switch signal circuit to the BCM indicting the door open position. In response to this signal, the BCM then applies battery voltage to the courtesy lamp relay control circuit energizing the UPFITTR CTSY LAMPS PCB Relay. With the relay energized. battery voltage is applied through the switch side of the relay and the supply voltage circuits illuminating the courtesy lamps.

Courtesy Lamps Manual Operation

The courtesy lamps can be manually turned ON by the IP dimmer switch. When the dimmer switch is placed in the DOME position, ground is applied through the dimmer switch and the courtesy lamp switch ON signal circuit to the BCM indicating the courtesy lamps ON request. In response to this signal, the BCM then applies battery positive voltage through the courtesy lamp supply voltage circuits illuminating the courtesy lamps listed above. The courtesy lamps ON operation of the dimmer switch will override any BCM operation of the interior lamps already in progress.

Keyless Entry Interior Illumination

When the remote function actuator transmitter is used to unlock the doors, the BCM receives a door-unlock signal. The BCM must have inputs that indicate that the ignition switch is OFF, the courtesy lamp switch is OFF, and all the doors are closed. The BCM will then illuminate the courtesy lamps and will remain illuminated for approximately 25 seconds after the door is closed. If the door locks are activated to the LOCK position, or if the ignition switch is turned to either the RUN or START position, the BCM will turn OFF the courtesy lamps immediately.

Courtesy/Illuminated Exit

The illuminated exit feature will activate the courtesy lamps when the key IN input of the BCM transitions from an active state to an inactive state (removing the ignition key). When the key is removed from the ignition, the key IN input to the BCM becomes inactive. The BCM will illuminate the courtesy lamps for approximately 25 seconds.

Theater Dimming

The theater dimming feature that will slowly dim the interior lamps from full brightness to OFF. The following actions will over ride the theater dimming feature causing the courtesy lamps to deactivate immediately if no other BCM function commands the courtesy lamps ON:

- A transition from active to inactive of the interior lamps switch, turning OFF the interior lamps switch
- A LOCK command from the remote keyless entry system
- A last door closed locking function, locking and closing all the doors

Underhood Compartment Lamp

The BCM supplies battery positive voltage through the inadvertent power courtesy lamps circuit to the underhood compartment lamp. When the hood is opened, the underhood compartment lamp switch closes to ground and the lamp illuminates.

Dome/Reading Lamps

The dome/reading lamp is a duel purpose lamp that can be illuminated two different ways. First, the lamp can be turned ON during courtesy lamp operation as described above. Second, the lamps can be turned ON individually for reading lamp operation by the lamp switch. The BCM supplies battery voltage through the inadvertent power courtesy lamp circuit to the dome/reading lamp for reading lamp operation only.

Sunshade Vanity Mirror Lamps

The BCM supplies battery voltage through the inadvertent power courtesy lamps circuit to the left and right vanity mirror lamps. When the vanity mirror cover on the sunshade is opened, the vanity mirror lamp switch is closed to ground and the lamp illuminates.

Interior Lamps Dimming

The second interior lighting group includes lamps which may be dimmed. This group may use a combination of vacuum fluorescent (VF) illumination, LED illumination and incandescent lamps.

- Headlamp switch
- Tow/haul switch
- Traction control switch
- HVAC control module
- Driver window switch
- Driver power door lock switch
- Auxiliary blower motor switch
- Front passenger window switch
- Front passenger door lock switch
- Front auxiliary HVAC control assembly

- Rear auxiliary HVAC control assembly
- Steering wheel controls
- Inflatable restraint I/P module disable switch
- Driver information center (DIC) display switch
- Radio

When the ignition switch is turned to the RUN position, the instrument panel cluster (IPC), radio VF display, and the HVAC control assembly turns ON at maximum brightness. When the headlamp switch is in the PARK or HEADLAMP ON position, all incandescent and LED back lighting turn ON at the dimming level indicated by the instrument panel (I/P) dimmer switch. The dimmer switch is used to increase and decrease the brightness of the interior backlighting components. The BCM supplies a voltage reference through the I/P dimming voltage reference circuit to the interior lamp dimmer switch, which is part of the headlamp switch. When the dimmer switch is placed in a desired brightness position, reference voltage is applied through the dimmer switch rheostat and the I/P lamps dimmer switch signal circuit to the BCM. The BCM interprets this voltage signal, then applies a pulse width modulated (PWM) voltage through the I/P lamps supply voltage circuits and the LED dimming supply circuit to all related interior backlighting lamps illuminating them to the desired level of brightness.

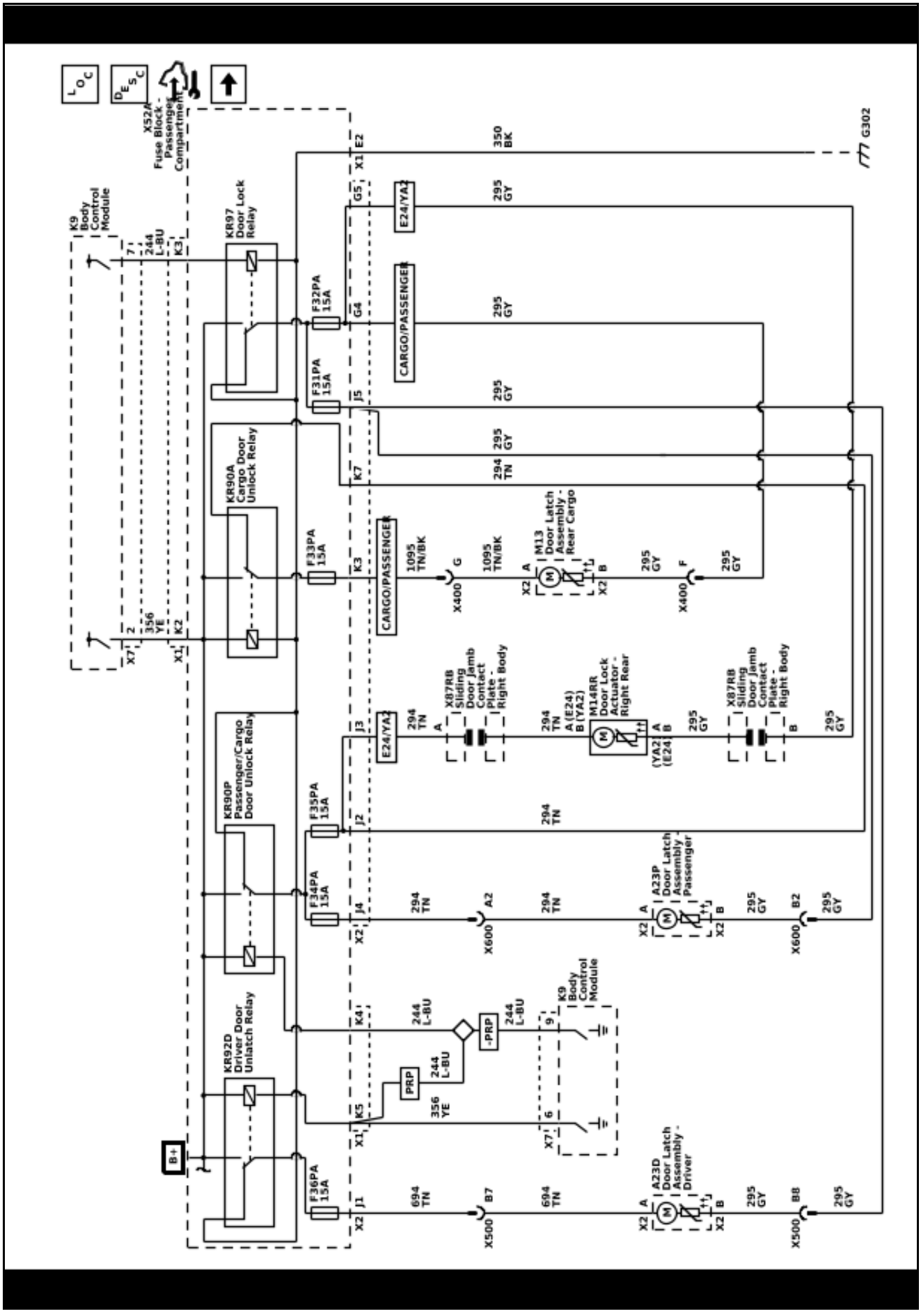
Battery Rundown Protection / Inadvertent Power

The BCM controls the lighting system through circuits that enable the exterior lamp functions of the park lamps, the head lamps, the fog lamps, and the interior lamps. The BCM opens these enabling circuits 10 minutes after the ignition switch is turned OFF with no lamp switch activity. If the ignition switch is turned to any position other than OFF, or if a lamp switch is activated during this time period, the timer resets for another 10 minutes.

Vehicle Access

Schematic and Routing Diagrams

Door Lock/Indicator Schematics (Lock/Unlock Control)



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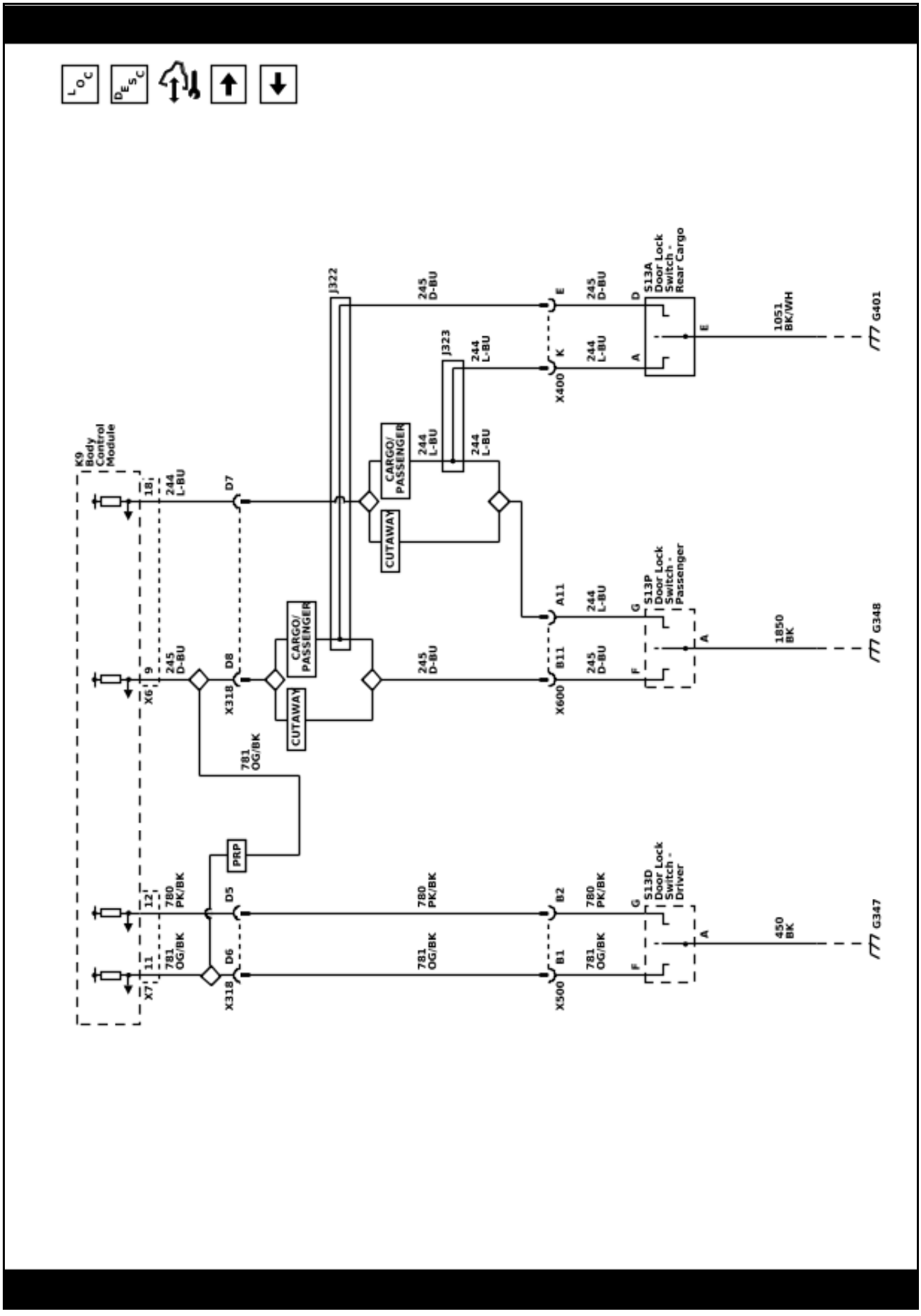
Door Lock/Indicator Schematics (Door Lock Switches (AU3))



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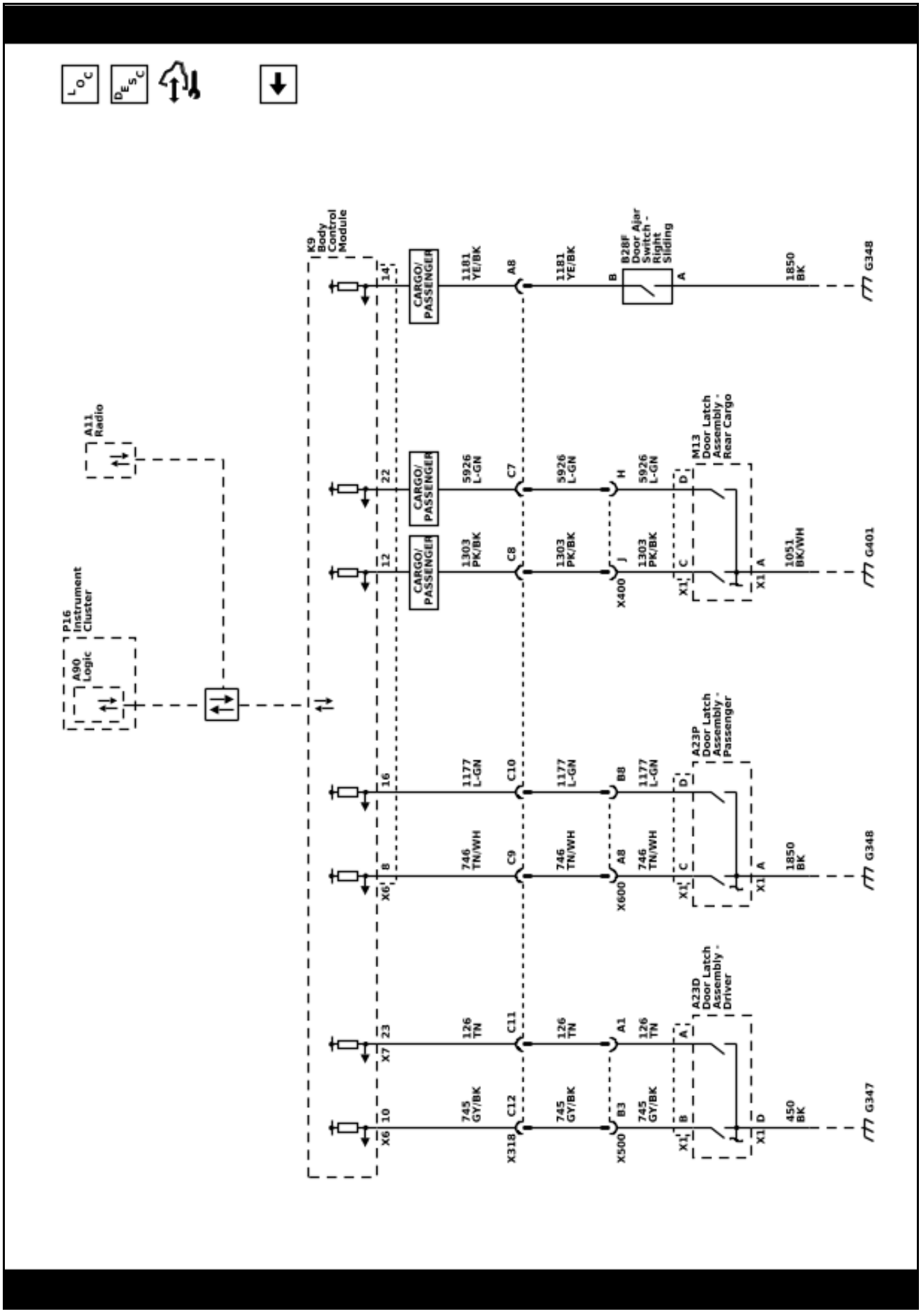
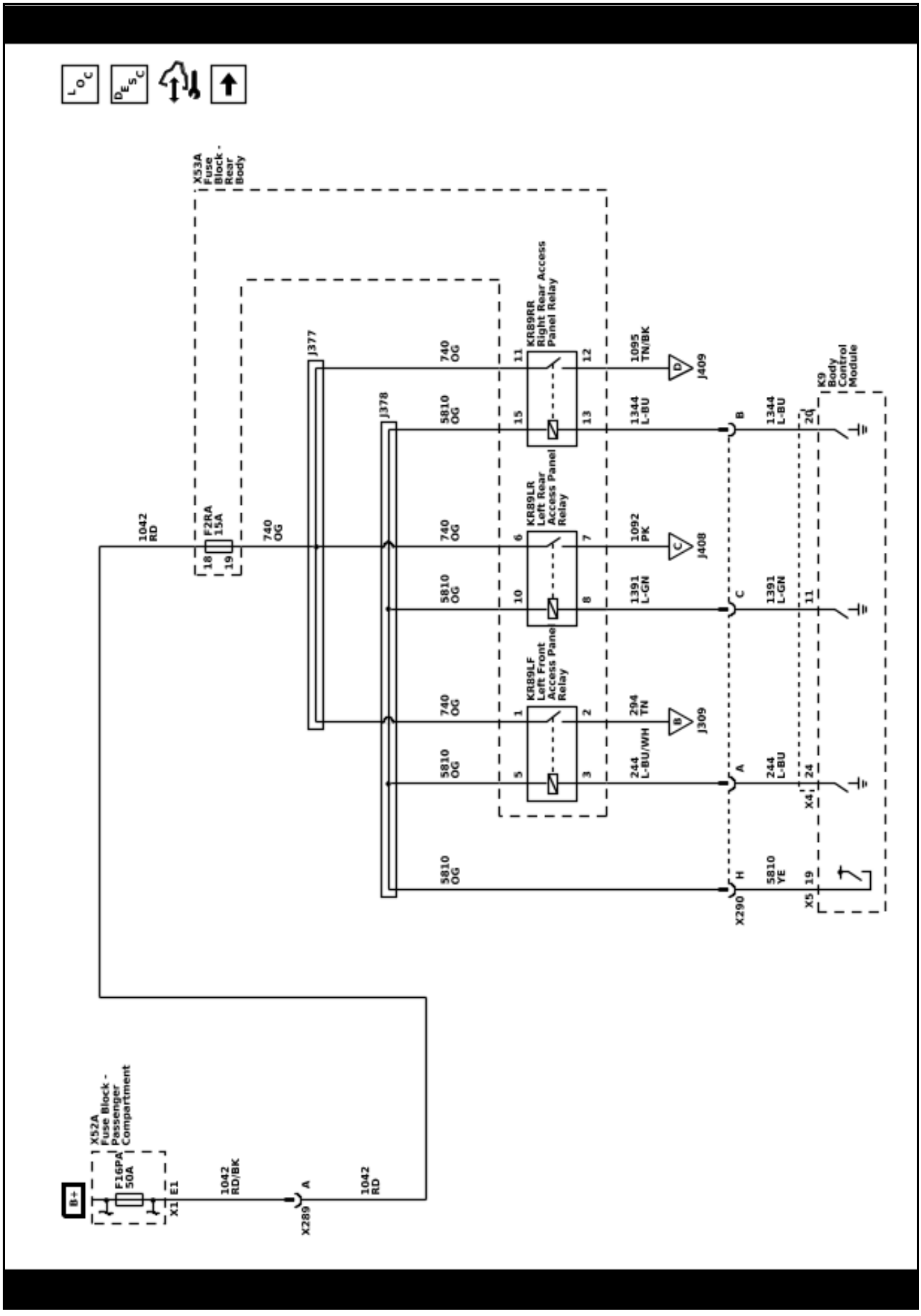
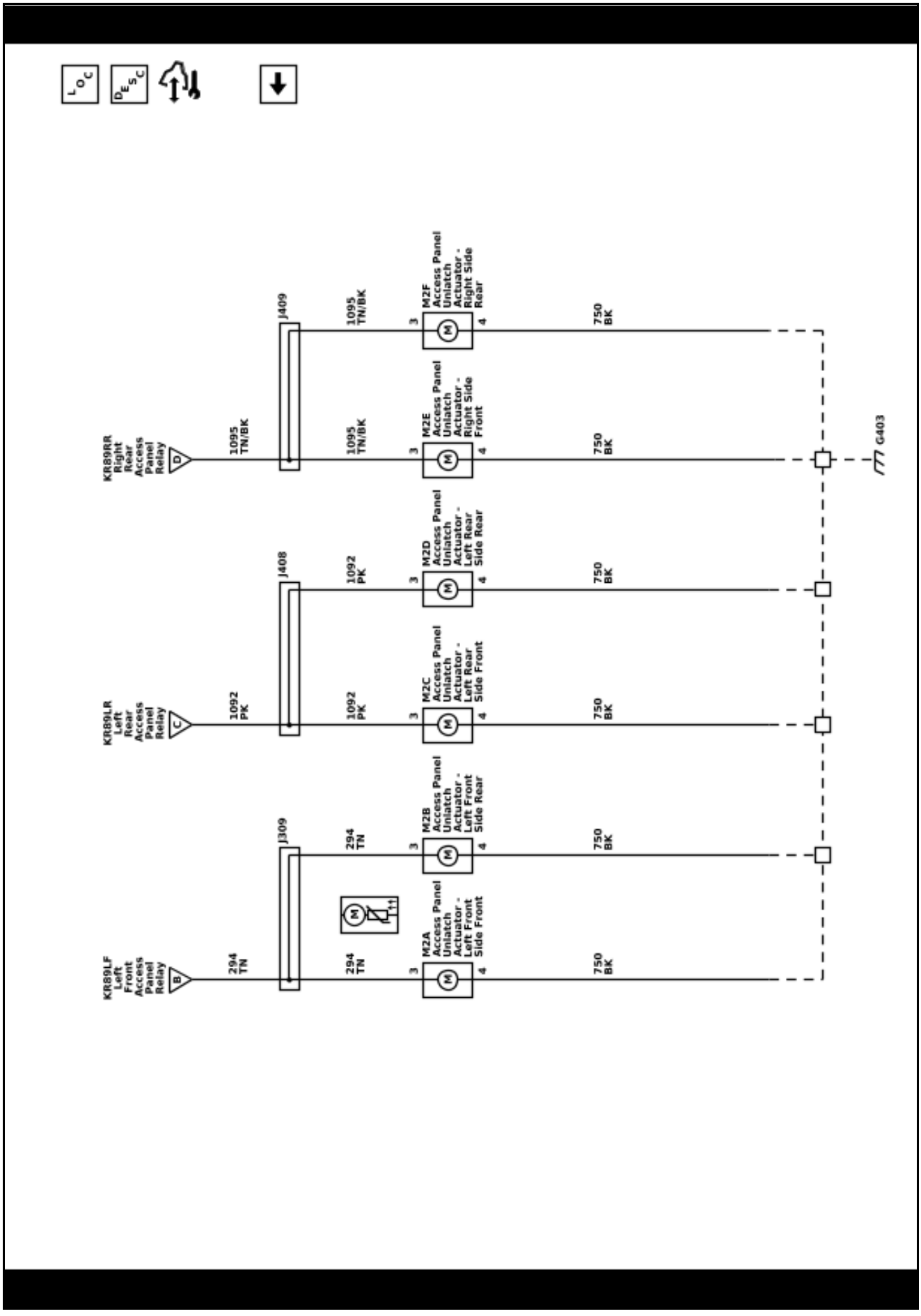
Door Lock/Indicator Schematics (Door Ajar Switches)



Release Systems Schematics (Side Access Panel Relay Controls (PRP))



Release Systems Schematics (Side Access Panel Actuators (PRP))


LOC
DESC
KR89LF Left Front Access Panel Relay
KR89LR Left Rear Access Panel Relay
KR89RR Right Rear Access Panel Relay
294 TN
1092 PK
1095 TN/BK
750 BK
J309
J408
J409
M2A Access Panel Unlatch Actuator - Left Front Side Front
M2B Access Panel Unlatch Actuator - Left Front Side Rear
M2C Access Panel Unlatch Actuator - Left Rear Side Front
M2D Access Panel Unlatch Actuator - Left Rear Side Rear
M2E Access Panel Unlatch Actuator - Right Side Front
M2F Access Panel Unlatch Actuator - Right Side Rear
G403
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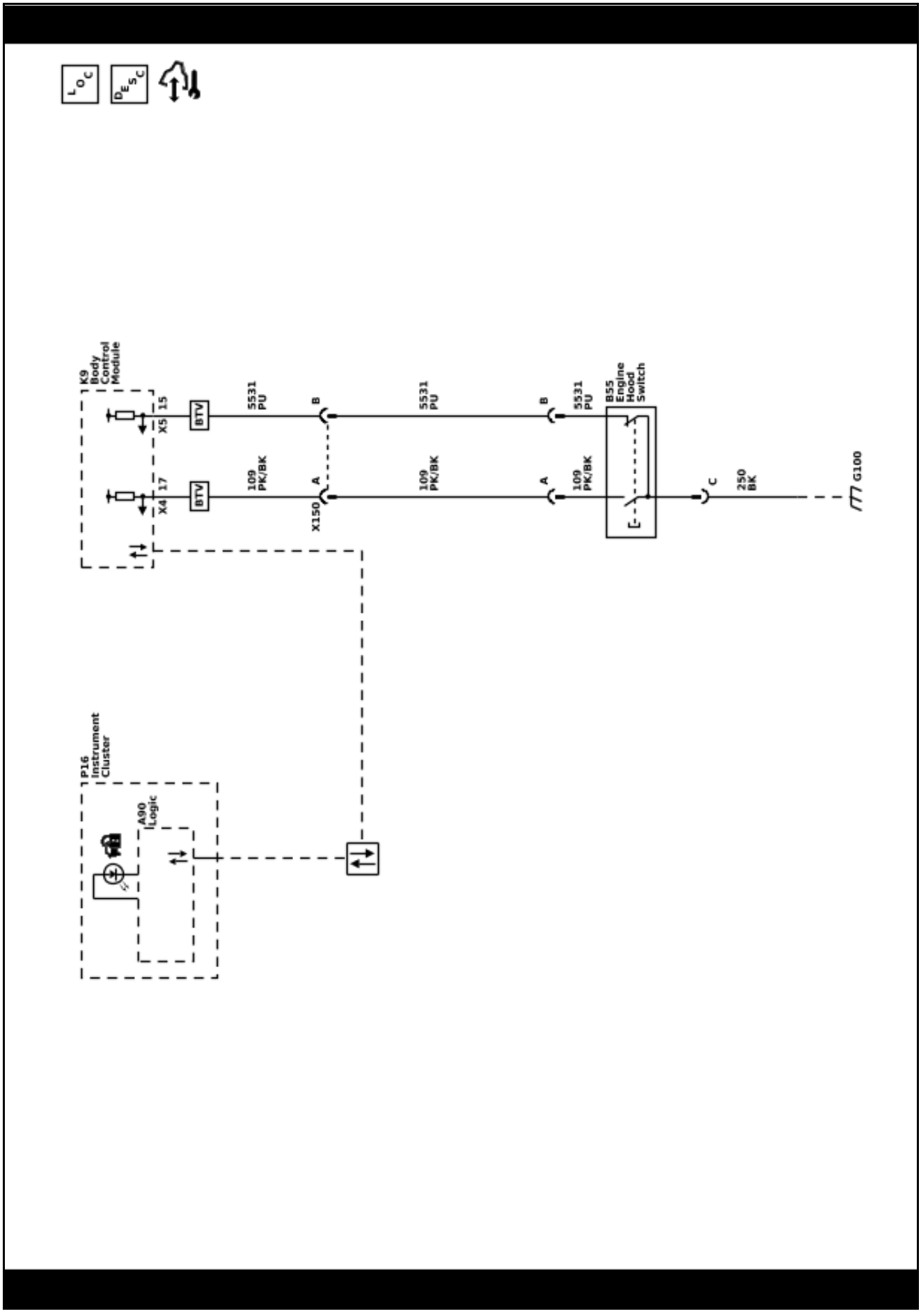
Hood Latch Schematics (Hood Latch)



Description and Operation

Door Ajar Indicator Description and Operation

Door Ajar Indicator System Components

The door ajar indicator system consists of the following components:

- The body control module (BCM)
- The instrument panel cluster (IPC)
- The driver information center (DIC)
- The door ajar switch

Door Ajar Operation

The body control module (BCM) receives a discrete input from the door ajar switch to indicate the status of the door. The BCM then communicates this status to the instrument panel cluster (IPC) via GMLAN serial data. The IPC, upon receipt of this message, will illuminate the door ajar message in the driver information center (DIC) and also send a GMLAN serial data message to the radio to activate the door ajar audible warning when the following conditions are met:

- The transmission is shifted out of PARK.
- The vehicle speed is greater than 8 km/h (5 mph).

Power Door Locks Description and Operation

Door Lock System Components

The power door lock system consists of the following components:

- Driver door lock switch
- Front passenger door lock switch
- Rear cargo door lock switch
- Door lock relay
- Passenger door unlock relay
- Driver door unlock relay
- Cargo door unlock relay
- Body Control Module (BCM)
- Reversible door lock actuators in each of the doors
- DRV LKS 10A fuse, driver door unlock relay supply voltage
- CARGO UNLK 10A fuse, cargo door unlock relay supply voltage
- DOOR LKS 20A fuse, door lock relay and passenger door unlock relay supply voltage

Door Lock System Controls

The power door lock system can be controlled by any of the following:

- A power door lock or unlock switch activation
- A keyless entry transmission
- A lock out prevention function
- A last door locking function

Driver, Passenger and Cargo Door Lock Operation

When any of the door lock switches are placed in the lock position, a ground signal is applied to the BCM through the door lock signal circuit. Upon receiveing this signal, the BCM grounds the control side of the door lock relay through the door lock relay control circuit. Since the other side of the door lock relay winding is connected to battery voltage, the relay is energized. This causes the contacts to close and complete the path from the DOOR LKS fuse through the battery voltage circuit. Voltage is then applied to the lock side of the door lock actuators through the door lock actuator lock circuits. Since the other side of the all the door lock actuators are connected to the normally closed contacts of their respective unlock relays to ground, the doors lock.

The lock function can also be accomplished by the BCM supplying ground to the door lock relay control circuit by either of the following:

- A keyless entry lock transmission
- A last door lock function

Driver Door Unlock Operation

When any of the door lock switches are placed in the unlock position, a ground signal is applied to the BCM through the door unlock signal circuit. Upon receiveing this signal, the BCM grounds the control side of the driver door unlock relay through the driver door unlock relay control circuit. Since the other side of the driver door unlock relay winding is connected to battery voltage, the relay is energized. This causes the contacts to close and complete the path from the DRV LKS fuse through the battery voltage circuit. Voltage is then applied to the unlock side of the driver door lock actuator through the driver door lock actuator unlock control circuit. Since the other side of the the driver door lock actuator is connected to the normally closed contacts of the door lock relay to ground, the driver door unlocks.

The driver door unlock function can also be accomplished by the BCM supplying ground to the driver door unlock relay control circuit by either of the following:

- A keyless entry unlock transmission
- A lock out prevention function

Passenger Door Unlock Operation

When any of the door lock switches are placed in the unlock position, a ground signal is applied to the BCM through the door unlock signal circuit. Upon receiveing this signal, the BCM grounds the control side of the passenger door unlock relay through the door unlock relay control circuit. Since the other side of the door unlock relay winding is connected to battery voltage, the relay is energized. This causes the contacts to close and complete the path from the DOOR LKS fuse through the battery voltage circuit. Voltage is then applied to the unlock side of the passenger door lock actuators through the door lock actuator unlock control circuits. Since the other side of the the door lock actuators are connected to the normally closed contacts of the door lock relay to ground, the passenger doors unlock.

The door unlock function can also be accomplished by the BCM supplying ground to the passenger door unlock relay control circuit during a keyless entry unlock transmission.

Cargo Door Unlock Operation

When any of the door lock switches are placed in the unlock position, a ground signal is applied to the BCM through the door unlock signal circuit. Upon receiveing this signal, the BCM grounds the control side of the cargo door unlock relay through the cargo door unlock relay control circuit. Since the other side of the cargo door unlock relay winding is connected to battery voltage, the relay is energized. This causes the contacts to close and complete the path from the CARGO UNLK fuse through the battery voltage circuit. Voltage is then applied to the unlock side of the cargo door lock actuator through the door lock actuator unlock control circuit. Since the other side of the the cargo door lock actuator is connected to the normally closed contacts of the door lock relay to ground, the cargo door unlocks.

The cargo door unlock function can also be accomplished by the BCM supplying ground to the cargo door unlock relay control circuit during a keyless entry unlock transmission.

Delay Locking Operation

This feature allows the operator to lock all the doors from a door lock switch with the side doors(s) open. The side cargo doors have contact plates that complete the power door lock and unlock control circuits, among others, when the side cargo doors are closed, and interrupt these circuits when the doors are open. When a lock function occurs and the BCM senses an active state on any door ajar switch signal circuit the driver, front passenger and cargo doors will lock as described. The BCM continues to monitor door ajar switch signal circuits. When the BCM senses an inactive state, door closed, the BCM will cycle the door lock relay again after approximately 5 seconds to perform another lock function, thus locking the side cargo door(s).

Lockout Prevention

This feature prevents the locking of the driver door if the ignition key is left in the ignition lock cylinder. If a lock function occurs from any door lock switch and the BCM senses a door ajar and the key in ignition switch signal circuit is in the yes state, the BCM will cycle the door lock relay to lock the doors and then cycle the driver door unlock relay to unlock the driver door.

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Section 3

Driver Information and Entertainment

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Schematic and Routing Diagrams 3-3
Image Display Camera Schematics 3-4
Description and Operation 3-5
Rear Vision Camera Description and Operation 3-5

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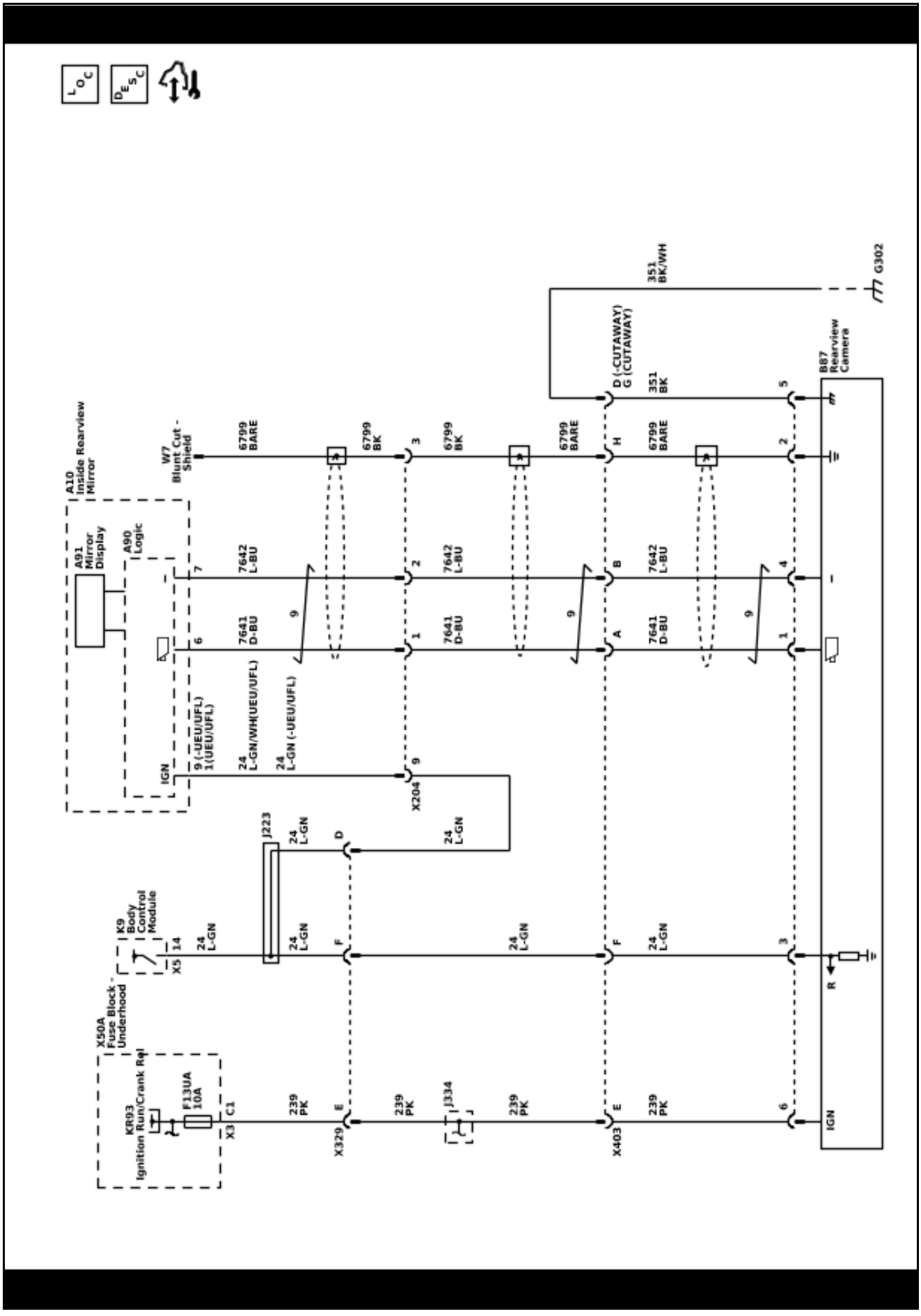
Image Display Cameras

Schematic and Routing Diagrams

Image Display Camera Schematics (Rear Vision Camera (UVC))



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Description and Operation

Rear Vision Camera Description and Operation

The rear vision camera system consists of the rearview camera and the infotainment system.

When the transmission is placed into R, 12 V is applied to the reverse lamp control circuit by the body control module (BCM). The rearview camera monitors this circuit and when 12 V is seen, indicating that the transmission is in R, the rearview camera will activate. The rearview camera receives ignition voltage and a constant ground to power the camera. Video signal + and video signal – circuits carry the video image from the rearview camera to the infotainment system. Additionally, the video signal circuits are shielded to prevent any interference which may lead to a loss of video signal resolution and cause a degraded video image. The shield is grounded by the rearview camera.

The following conditions may cause a degraded rear vision camera image:

- Ice, snow, or mud has built up on the rear vision camera
- Dark conditions
- Extreme light conditions, such as glare from the sun or the headlights of another vehicle
- Damage to the rear of the vehicle
- Extreme high temperatures or extreme temperature changes

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Section 4

Engine/Propulsion

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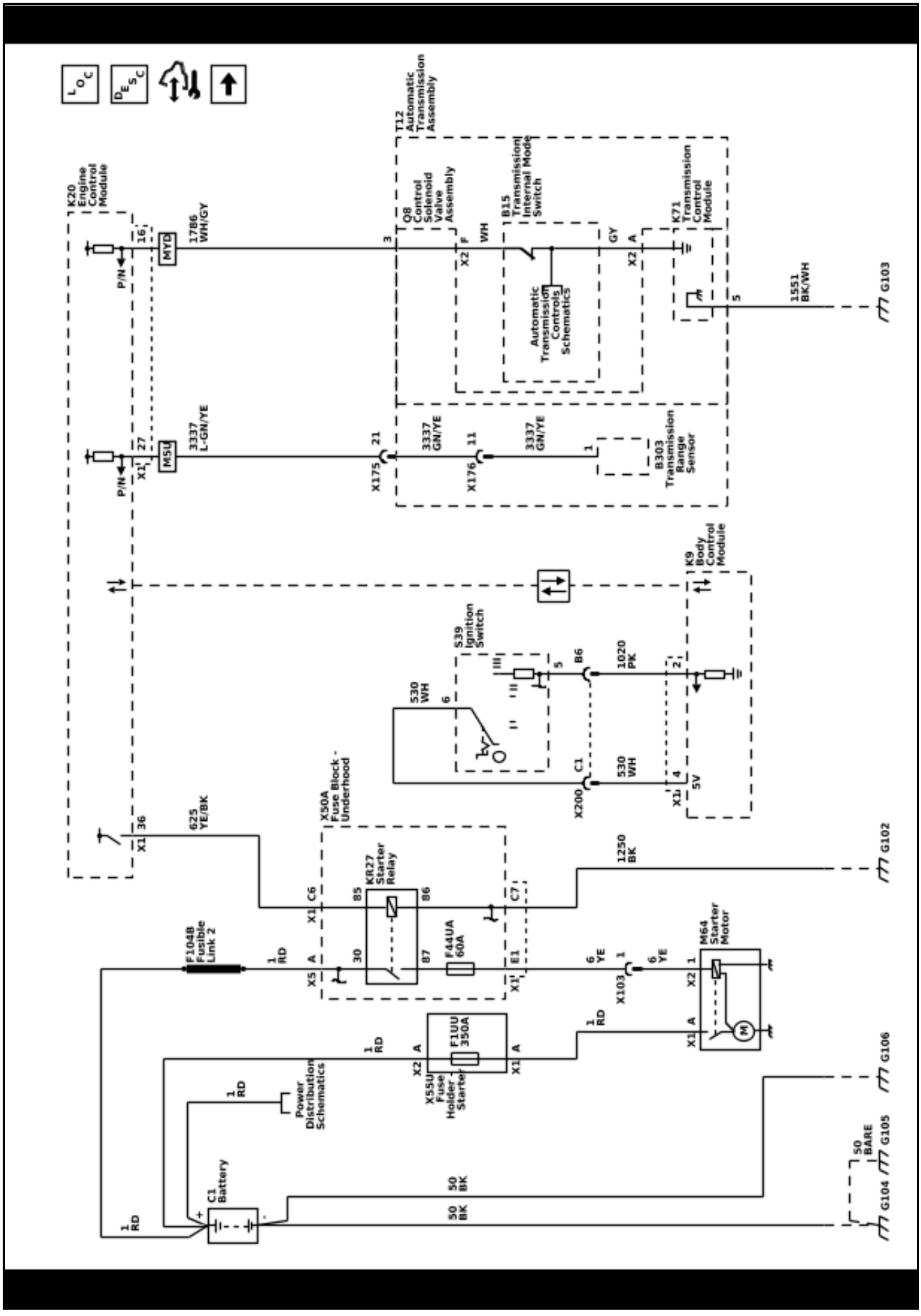
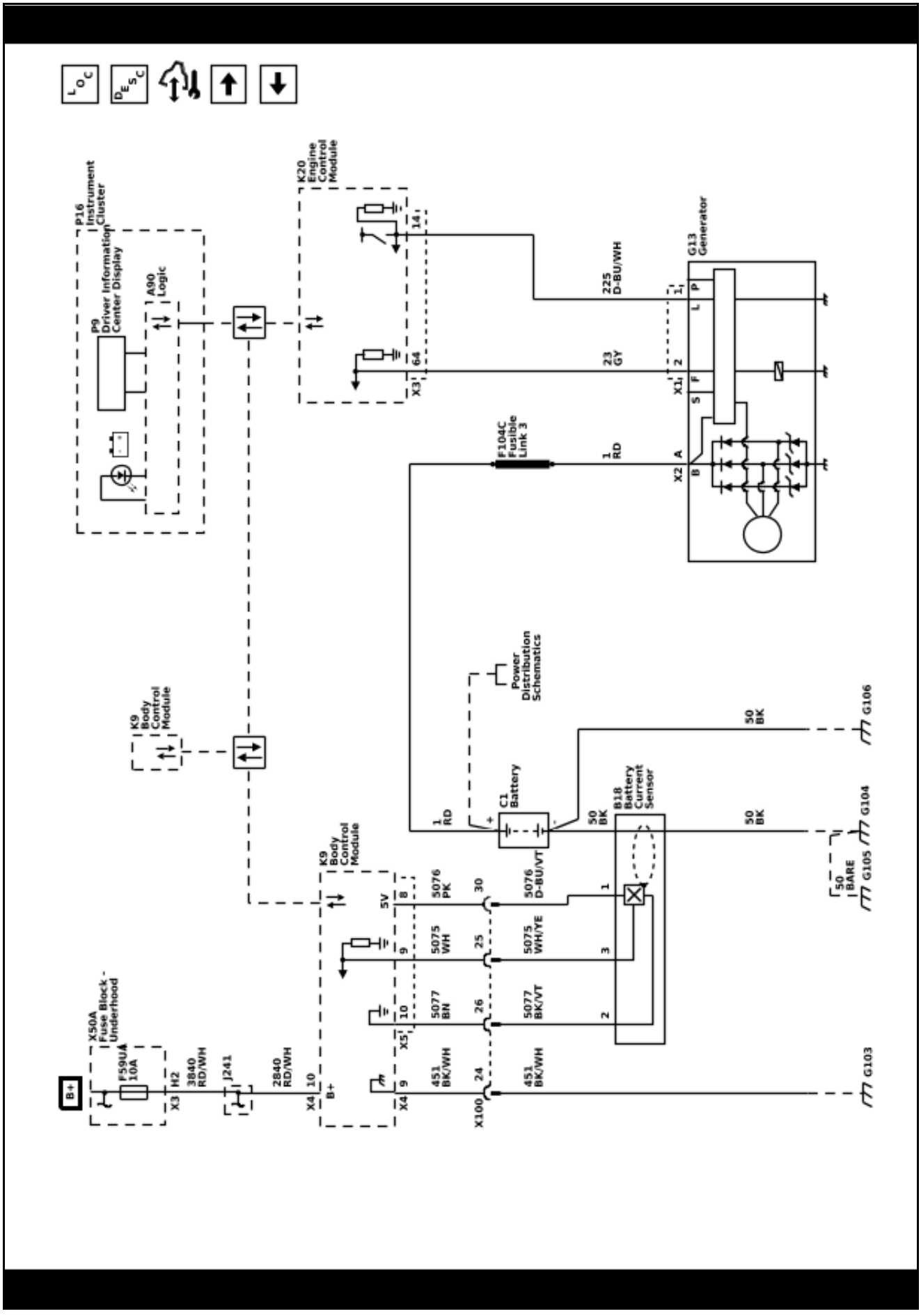
12 V Starting and Charging

Schematic and Routing Diagrams

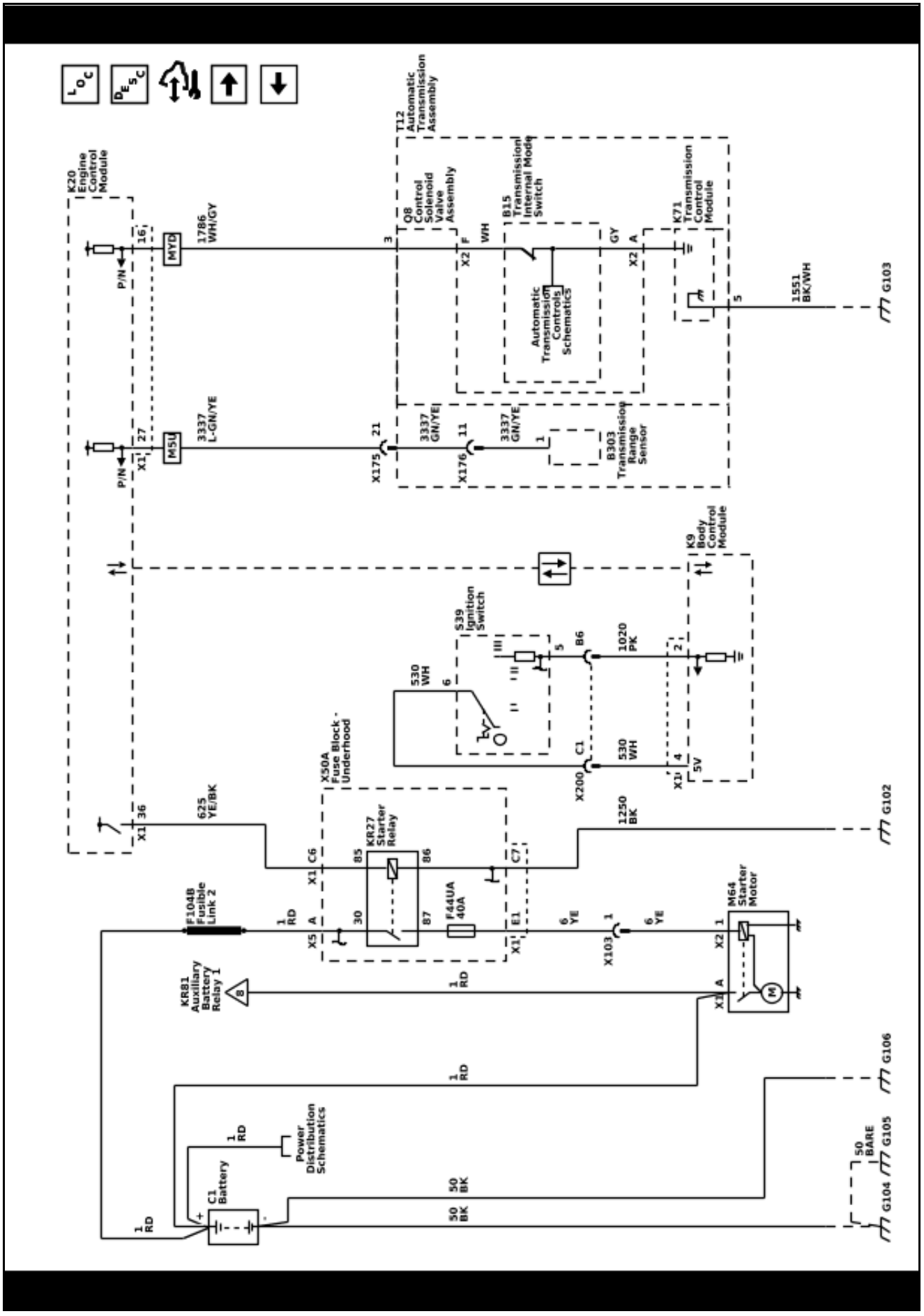
Starting and Charging Schematics (Starting System (Gas with One Battery))



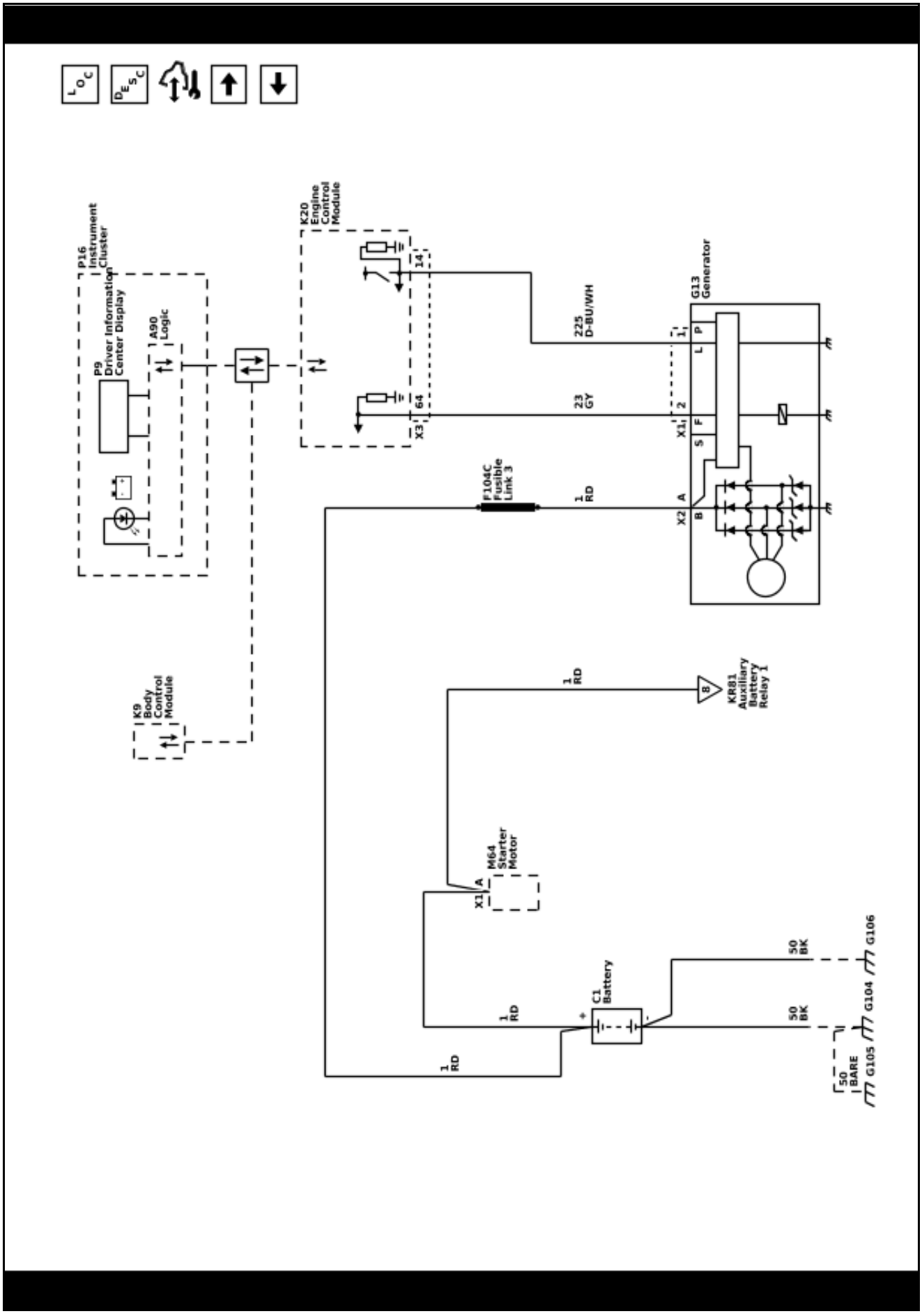
Starting and Charging Schematics (Charging System (Gas with One Battery))



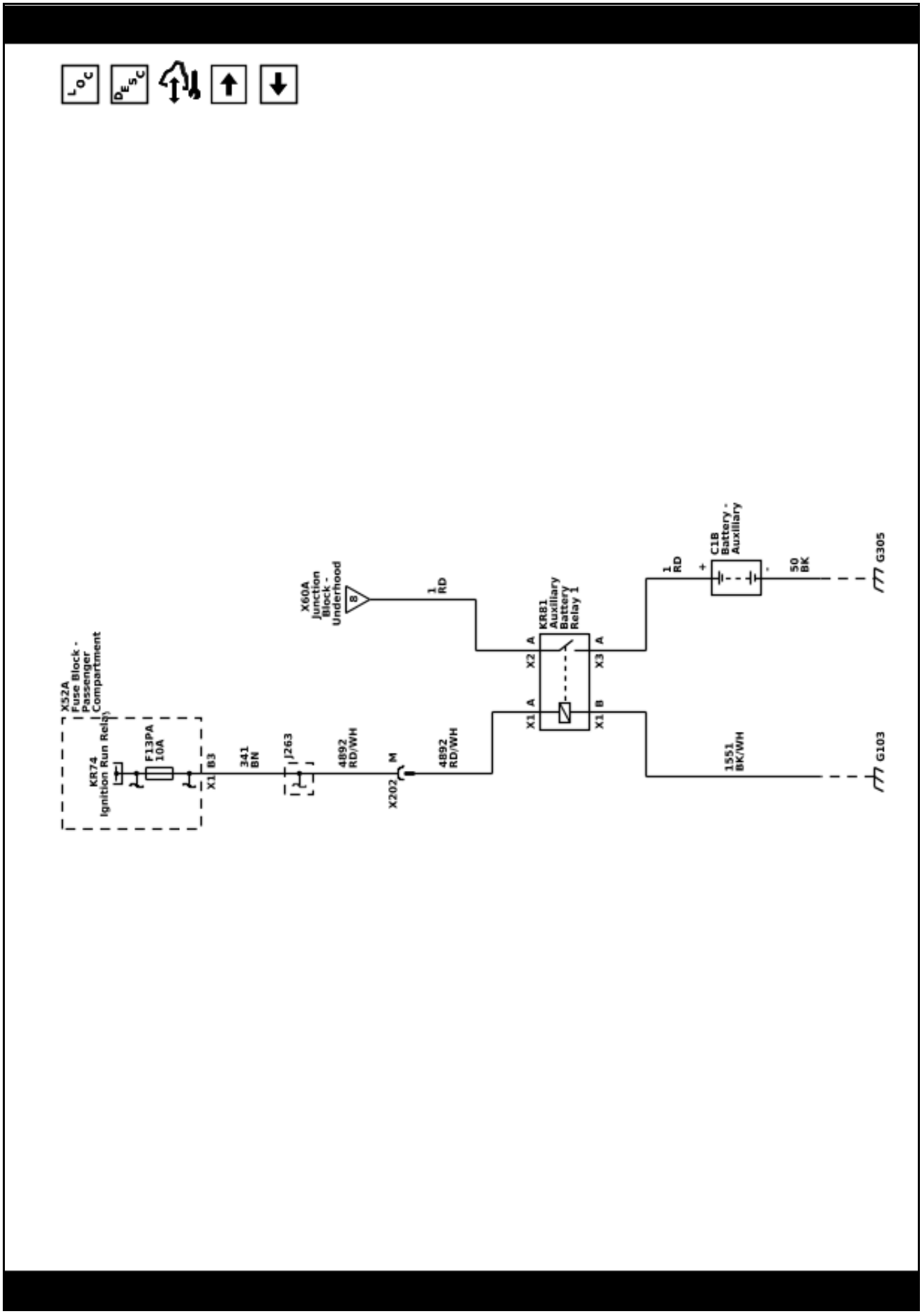
Starting and Charging Schematics (Starting System (Gas with Two Batteries))



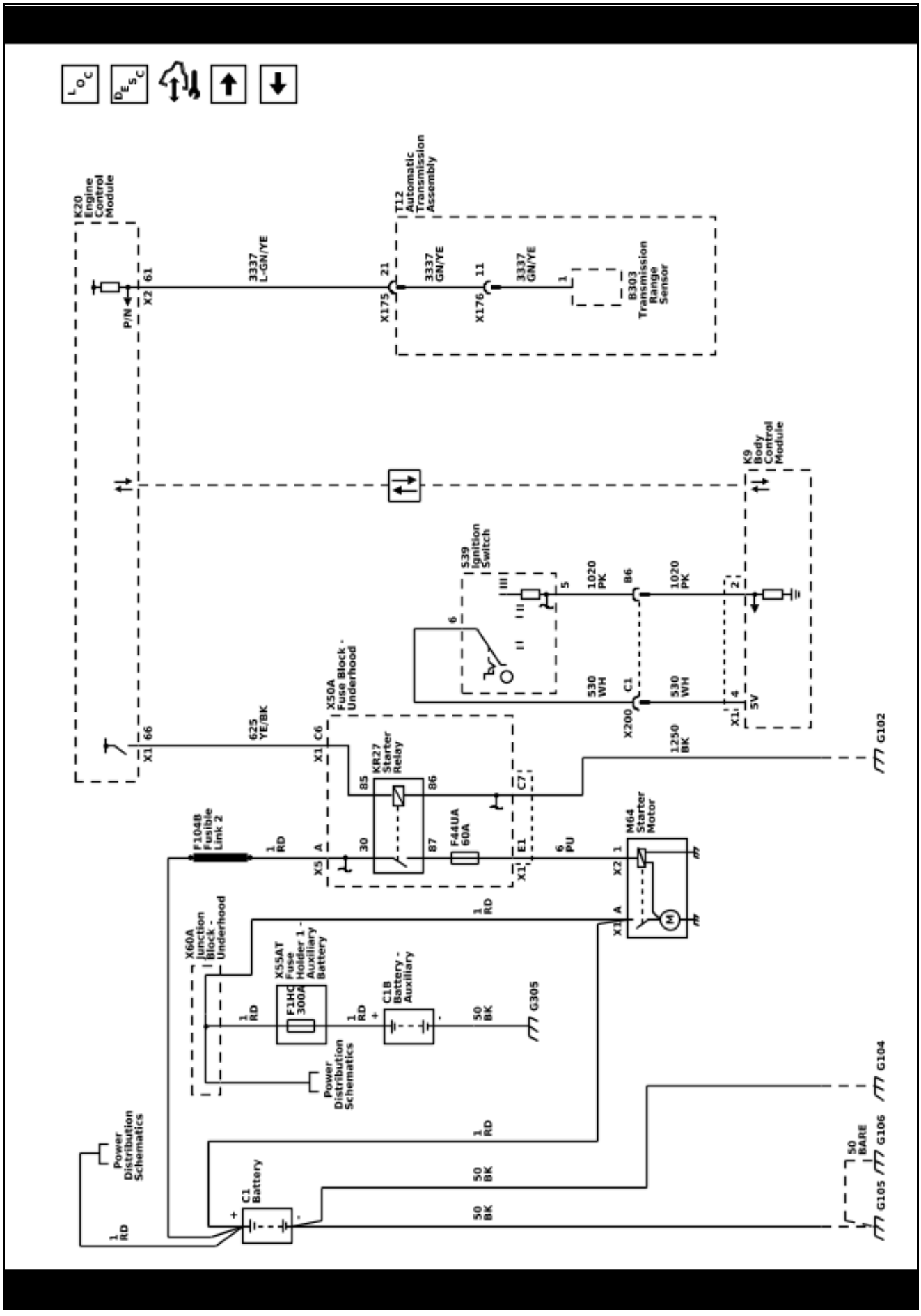
Starting and Charging Schematics (Charging System (Gas with Two Batteries))



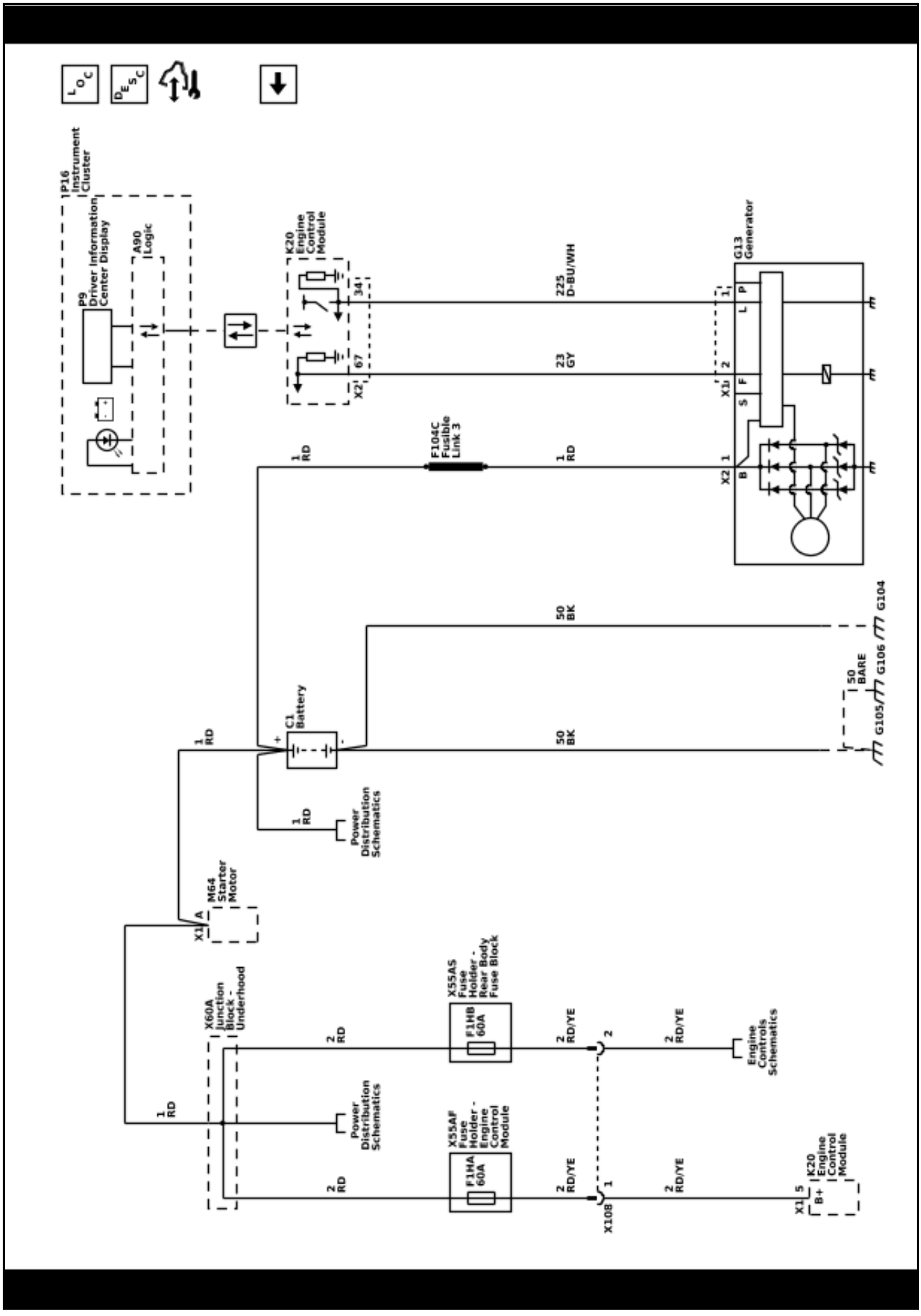
Starting and Charging Schematics (Auxiliary Battery Relay and Auxiliary Battery (Gas with Two Batteries))



Starting and Charging Schematics (Starting System (Diesel))



Starting and Charging Schematics (Charging System (Diesel))



Description and Operation

Battery Description and Operation

Warning: Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- ***Always shield your eyes and avoid leaning over the battery whenever possible.***
- ***Do not expose the battery to open flames or sparks.***
- ***Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.***
- ***Follow each step of the jump starting procedure in order.***
- ***Treat both the booster and the discharged batteries carefully when using the jumper cables.***

Batteries that are no longer wanted must be disposed of by an approved battery recycler and must never be thrown in the trash or sent to a landfill.

Batteries that are not part of the vehicle itself, not the battery under the hood, must only be transported on public streets for business purposes via approved hazardous material transportation procedures.

Battery storage, charging and testing facilities in repair shops must meet various requirements for ventilation, safety equipment, material segregation, etc.

The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for 2 small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

The battery has 3 functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload

Battery Low Start Vehicle Message

The body control module (BCM) monitors battery positive voltage to determine battery state of charge. If one or more of the BCM battery positive voltage terminals measure less than approximately 11.6V compared to the BCM ground circuits, this message will display and four chimes may sound. Start the vehicle immediately. If the vehicle is not started and the battery continues to discharge, the climate controls, heated seats, and audio systems will shut off and the vehicle may require a jump start. These systems will function again after the vehicle is started.

Battery Ratings

A battery has 2 ratings:

- Cold cranking amperage
- Amperage hours

When a battery is replaced use a battery with similar ratings. See battery specification label on the original battery.

Amperage Hours

The amperage hour rating tells you how much amperage is available when discharged evenly over a 20 hour period. The amperage hour rating is cumulative, so in order to know how many constant amperage the battery will output for 20 h, you have to divide the amperage hour rating by 20. Example: If a battery has an amperage hour rating of 74, dividing by 20 = 3.75. Such a battery can carry a 3.75 A load for 20 hours before dropping to 10.5 V. (10.5 V is the fully discharged level, at which point the battery needs to be recharged.) A battery with an amperage hour rating of 55 will carry a 2.75 A load for 20 hours before dropping to 10.5 V.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at −18°C (0°F) while maintaining at least 7.2 V. See battery label for the cold cranking amperage rating of this battery.

Charging System Description and Operation

Electrical Power Management Overview

The electrical power management system is designed to monitor and control the charging system and send diagnostic messages to alert the driver of possible problems with the battery and generator. This electrical power management system primarily utilizes existing on-board computer capability to maximize the effectiveness of the generator, to manage the load, improve battery state-of-charge and life, and minimize the system's impact on fuel economy. The electrical power management system performs 3 functions:

- Monitor the battery voltage and estimate the battery condition
- Take corrective actions by boosting idle speeds, and adjusting the regulated voltage
- Perform diagnostics and driver notification

The battery condition is estimated during ignition/vehicle off and during ignition/vehicle on. During ignition/vehicle off the state-of-charge of the battery is determined by measuring the open-circuit voltage. The state-of-charge is a function of the acid concentration and the internal resistance of the battery, and is estimated by reading the battery open circuit voltage when the battery has been at rest for several hours.

Any time the ignition/vehicle is on, the vehicle algorithm continuously estimates battery state-of-charge based on adjusted net amp hours, battery capacity, initial state-of-charge, and calculated temperature.

While the engine is running, the battery degree of discharge is primarily determined by the integrated battery current sensor, to obtain net amp hours.

In addition, the electrical power management function is designed to perform regulated voltage control to improve battery state-of-charge, battery life, and fuel economy. This is accomplished by using knowledge of the battery state-of-charge and temperature to set the charging voltage to an optimum battery voltage level for recharging without detriment to battery life.

Charging System Components

Generator

The engine drive belt drives the generator. When the rotor is spun, it induces an alternating current (AC) into the stator windings. The AC voltage is then sent through a series of diodes for rectification. The rectified voltage has been converted into a direct current (DC) for use by the vehicles electrical system to maintain electrical loads and the battery charge. The voltage regulator integral to the generator controls the output of the generator; It is not serviceable. The voltage regulator controls the amount of current provided to the rotor. If the generator has field control circuit fault, the generator defaults to an output voltage of 13.8 V.

The generator is serviced as a complete assembly. If there is a diagnosed fault in the generator, it must be replaced as an assembly.

Generator Pulley

The pulley drives the Generator via the engine drive belt. There are 2 types of pulleys:

1. Conventional solid Pulley which is bolted to the Generator stator shaft. This Pulley can be serviced separately.

2. One Way Clutch Pulley or Overrunning Alternator Decoupler Pulley allows the Generator to spin freely when the engine rapidly slows down on sudden deceleration. This part is not serviceable and the Generator needs to be replaced as an assembly.

Body Control Module (BCM)

The BCM communicates with the Engine Control Module (ECM) and the instrument cluster for electrical power management operation. The BCM determines the output of the generator and sends the information to the ECM for control of the generator turn on signal circuit. It monitors the generator field duty cycle signal circuit information sent from the ECM for control of the generator. It monitors the battery current sensor, the battery positive voltage circuit, and estimates battery temperature to determine battery state of charge. The BCM also performs idle boost.

Battery Current Sensor (if applicable)

The Battery Current Sensor is a serviceable component that is connected to the negative battery cable at the battery. The battery current sensor is a 3-wire hall effect current sensor. The battery current sensor monitors the battery current. It directly inputs to the BCM. It creates a 5 volt Pulse Width Modulation (PWM) signal of 128 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–95%. Between 0–5% and 95–100% are for diagnostic purposes.

Battery Sensor Module (if applicable)

The BCM monitors the Battery Sensor Module for battery state of current, state of health, and battery charge via serial data. If the battery is determined to be in poor state of health or having a low state of charge, the BCM will not allow the ECM to perform an auto-stop.

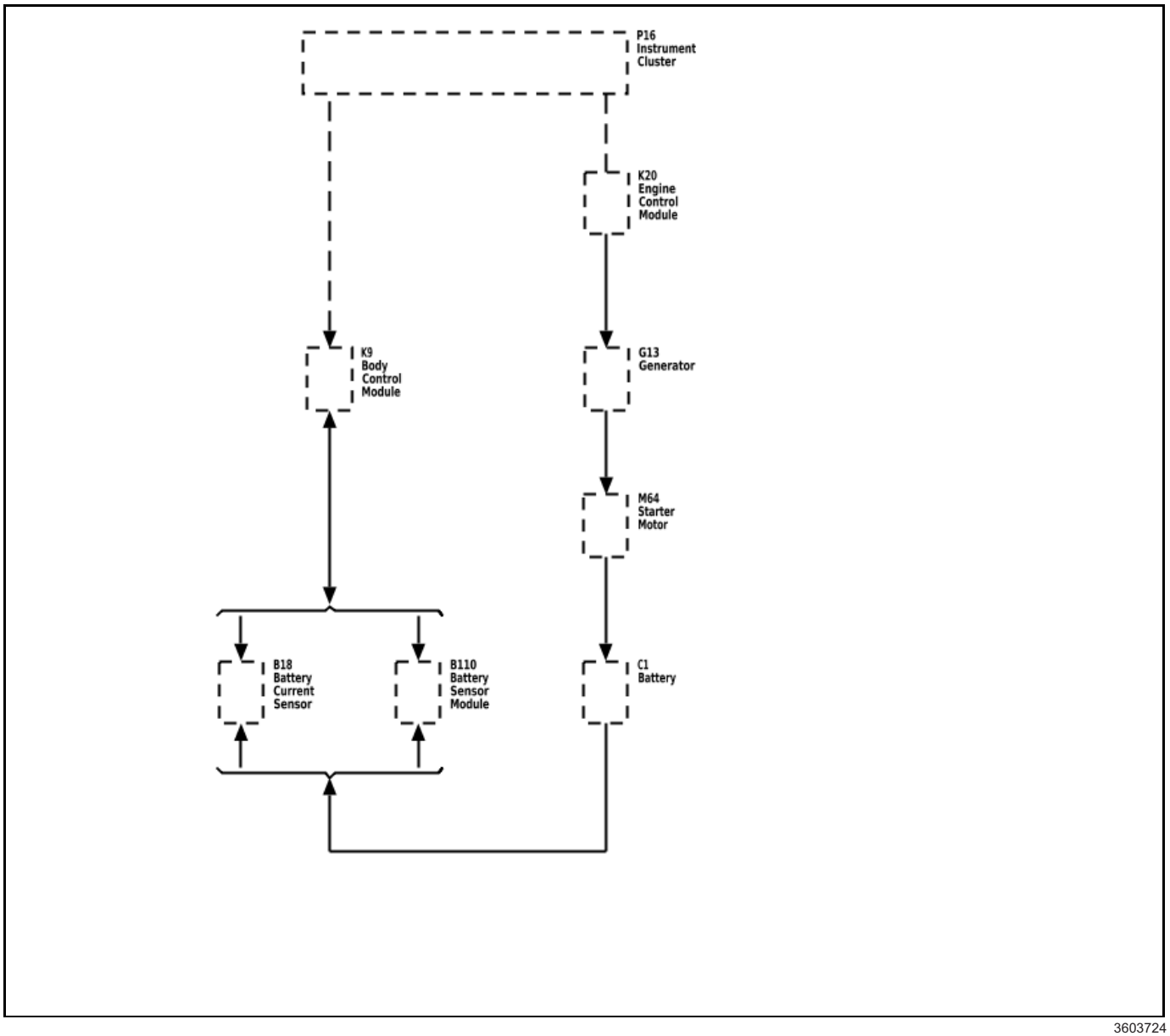
Engine Control Module (ECM)

When the engine is running, the generator turn-on signal is sent to the generator from the ECM, turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation. The generator field duty terminal is connected internally to the voltage regulator and externally to the ECM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the ECM that a problem exists. The ECM monitors the generator field duty cycle signal circuit, and receives control decisions based on information from the BCM.

Instrument Cluster

As a means of displaying the charging system functions, some vehicles may be equipped with a voltmeter gauge on the instrument cluster and/or a system voltage display in the driver information center. These will indicate the current vehicle system voltage.

The instrument cluster also provides customer notification if there is a concern with the charging system. There are two means of notification: a charge indicator on the instrument cluster and/or a service system message displayed on the Driver Information Center (DIC) if equipped.



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Charging System Operation

The purpose of the charging system is to maintain the battery charge and vehicle loads. There are 6 modes of operation and they include:

- Battery Sulfation Mode
- Charge Mode
- Fuel Economy Mode
- Head lamp Mode
- Start Up Mode
- Voltage Reduction Mode

The ECM Controls the Generator through the generator turn–on signal circuit, also known as the Generator L-terminal. The ECM monitors the generator performance though the Generator field duty cycle signal circuit, also known as the generator F-terminal.

The Generator turn–on signal (Generator L-terminal) is a Pulse Width Modulation (PWM) signal of 128 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–95%. 0–5% and 95–100% are for diagnostic purposes, with 0–5% monitoring for an open circuit and 95–100% monitoring for a short to ground at a fixed 13.8 V. The following table shows the commanded duty cycle and output voltage of the Generator:

Commanded Duty Cycle	Generator Output Voltage (+/- .25 V)
0–5%	13.8 V
10%	11 V
20%	11.56 V
30%	12.13 V
40%	12.69 V
50%	13.25 V
60%	13.81 V
70%	14.38 V
80%	14.94 V
90%	15.5 V
95–100%	13.8 V

The Generator provides a PWM feedback signal of the Generator voltage output through the Generator field duty cycle signal circuit to the ECM. This information is sent to the Body Control Module (BCM). The Generator field duty cycle signal (Generator F-terminal) is a PWM signal of 60–460 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–100%. 0–5% is reserved for diagnostic purposes.

As the charging systems works to maintain the battery charge and manage vehicle electrical loads, it is normal for the voltmeter gauge on the instrument cluster or the system voltage displayed in the DIC to fluctuate or change. This does not indicate a malfunction. Depending on the battery state of charge and the vehicle electrical load, these values may be anywhere from 12.5 V to 15.5 V.

Charging System Modes

Battery Sulfation Mode

The BCM will enter this mode when the interpreted Generator output voltage is less than 13.2 V for 45 minutes. When this condition exists the BCM will enter Charge Mode for 2–3 minutes. The BCM will then determine which mode to enter depending on voltage requirements.

Charge Mode

The BCM will enter Charge Mode when ever one of the following conditions are met:

- Windshield wipers are ON for more than 3 s.
- Climate Control Voltage Boost Mode Request is true, as sensed by the HVAC control module via serial data. High speed cooling fan, rear defogger, and HVAC high speed blower operation can cause the BCM to enter the Charge Mode.
- The estimated battery temperature is less than 0° C (32°F).
- Battery State of Charge is less than 80%.
- Vehicle speed is greater than 145 km/h (90 mph)
- A current sensor malfunction exists.
- System voltage is determined to be below 12.56 V

When any one of these conditions is met, the system will set targeted generator output voltage to a charging voltage between 13.9–15.5 V, depending on the battery state of charge and estimated battery temperature.

Fuel Economy Mode

The BCM will enter Fuel Economy Mode when the estimated battery temperature is at least 0°C (32°F) but less than or equal to 80°C (176°F), the calculated battery current is less than 15 A and greater than −8 A, and the battery state-of-charge is greater than or equal to 80%. Its targeted generator output voltage is the open circuit voltage of the battery and can be between 12.5–13.1 V. When fuel economy mode is active, the generator is not charging, only maintaining open circuit battery voltage. The BCM will exit this mode and enter Charge Mode when any of the conditions described above are present.

Headlamp Mode

The BCM will enter Headlamp Mode when ever the head lamps are ON (high or low beams). Voltage will be regulated between 13.9–14.5 V.

Start Up Mode

When the engine is started the BCM sets a targeted generator output voltage of 14.5 V for 30 s.

Tow/Haul Mode (if applicable)

Pressing the Tow/Haul Mode button located on the center stack, the vehicle system voltage is raised and the remote (non-vehicle) battery will be charged. Having the headlamps on will raise the system voltage and if the Tow/Haul button is applied it will not serve any purpose. The voltage is regulated between 13.9-14.5 V.

Instrument Cluster Operation

Charge Indicator Operation

The instrument cluster illuminates the charge indicator and displays a warning message in the driver information center if equipped, when the one or more of the following occurs:

- The ECM detects that the generator output is less than 11 V or greater than 16 V. The instrument cluster receives a serial data message from the ECM requesting illumination.
- The instrument cluster determines that the system voltage is less than 11 V or greater than 16 V for more than 30 s. The instrument cluster receives a serial data message from the BCM indicating there is a system voltage range concern.
- The instrument cluster performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 s.

Driver Information Center Message: BATTERY NOT CHARGING SERVICE CHARGING SYSTEM or SERVICE BATTERY CHARGING SYSTEM

The BCM and the ECM will send a serial data message to the driver information center for the BATTERY NOT CHARGING SERVICE CHARGING SYSTEM or SERVICE BATTERY CHARGING SYSTEM message to be displayed. It is displayed when a charging system DTC is a current DTC. The message is turned off when the conditions for clearing the DTC have been met.

Voltmeter Gauge and/or System Voltage Display (if equipped)

As a means of displaying the charging system functions, some vehicles may be equipped with a voltmeter gauge on the instrument cluster and/or a system voltage display in the driver information center. These will indicate the current vehicle system voltage.

As the charging systems works to maintain the battery charge and manage vehicle electrical loads, it is normal for the voltmeter gauge on the instrument cluster or the system voltage display in the driver information center to fluctuate or change. This does not indicate a malfunction. Depending on the battery state of charge and the vehicle electrical load, these values may be anywhere from 12.5 V to 15.5 V.

Electrical Power Management Description and Operation (Gasoline)

The electrical power management is used to monitor and control the charging system and alert the driver of possible problems within the charging system. The electrical power management system makes the most efficient use of the generator output, improves the battery state-of-charge, extends battery life, and manages system electrical loads.

The load shed operation is a means of reducing electrical loads during a low voltage or low battery state-of-charge condition.

The idle boost operation is a means of improving generator performance during a low voltage or low battery state-of-charge condition.

Each electrical power management function, either idle boost or load shed, is discrete. No two functions are active at the same time. Idle boost is activated in incremental steps, idle boost 1 must be active before idle boost 2 can be active. The criteria used by the body control module (BCM) to regulate electrical power management are outlined below:

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 1 Start	Less Than −15°C (5°F)	Less Than 13 V	—	First level Idle boost requested
Idle Boost 1 Start	—	—	Battery has a net loss greater than 0.6 AH	First level Idle boost requested
Idle Boost 1 Start	—	Less Than 10.9 V	—	First level Idle boost requested
Idle Boost 1 End	Greater Than −15°C (5°F)	Greater Than −12 V	Battery has a net loss less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	—	—	Battery has a net loss of 4 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 End	—	Greater Than 12 V	Battery has a net loss of less than 2 AH	Clear Load Shed 1
Idle Boost 2 Start	—	—	Battery has a net loss greater than 1.6 AH	Second level Idle boost requested
Idle Boost 2 Start	—	Less Than 10.9 V	—	Second level Idle boost requested
Idle Boost 2 End	—	Greater Than 12 V	Battery has a net loss less than 0.8 AH	Second level Idle boost request cancelled
Idle Boost 3 Start	—	—	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	—	Less Than 10.9 V	—	Third level Idle boost requested
Idle Boost 3 End	—	Greater Than 12 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Load Shed 2 Start	—	Less Than 10.9 V	Battery has a net loss greater than 12 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 End	—	Greater Than 12.6 V	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	—	Less Than 11.9 V	Battery has a net loss greater than 20 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 100% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 3 End	—	Greater Than 12.6 V	Battery has a net loss of less than 15 AH	Clear Load Shed 3

Electrical Power Management Description and Operation (Diesel)

The electrical power management is used to monitor and control the charging system and alert the driver of possible problems within the charging system. The electrical power management system makes the most efficient use of the generator output, improves the battery state-of-charge, extends battery life, and manages system electrical loads.

The load shed operation is a means of reducing electrical loads during a low voltage or low battery state-of-charge condition.

The idle boost operation is a means of improving generator performance during a low voltage or low battery state-of-charge condition. Idle boost consists of three steps: idle boost 1, idle boost 2, and idle boost 3 (approximately 725, 850, and 850 rpm respectively). Idle boost is activated in incremental steps, idle boost 1 must be active before idle boost 2 can be active.

Each electrical power management function, either idle boost or load shed, is discrete. No two functions are active at the same time. The criteria used by the body control module (BCM) to regulate electrical power management are outlined below:

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 1 Start	Less Than −15°C (5°F)	Less Than 13 V	—	First level Idle boost requested
Idle Boost 1 Start	—	—	Battery has a net loss greater than 0.6 AH	First level Idle boost requested
Idle Boost 1 Start	—	Less Than 10.9 V	—	First level Idle boost requested

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 1 End	Greater Than −15°C (5°F)	Greater Than −12 V	Battery has a net loss less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	—	—	Battery has a net loss of 4 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 End	—	Greater Than 12 V	Battery has a net loss of less than 2 AH	Clear Load Shed 1
Idle Boost 2 Start	—	—	Battery has a net loss greater than 1.6 AH	Second level Idle boost requested
Idle Boost 2 Start	—	Less Than 10.9 V	—	Second level Idle boost requested
Idle Boost 2 End	—	Greater Than 12 V	Battery has a net loss less than 0.8 AH	Second level Idle boost request cancelled
Idle Boost 3 Start	—	—	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	—	Less Than 10.9 V	—	Third level Idle boost requested
Idle Boost 3 End	—	Greater Than 12 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled
Load Shed 2 Start	—	Less Than 10.9 V	Battery has a net loss greater than 12 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 End	—	Greater Than 12.6 V	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	—	Less Than 11.9 V	Battery has a net loss greater than 20 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 100% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 3 End	—	Greater Than 12.6 V	Battery has a net loss of less than 15 AH	Clear Load Shed 3

Starting System Description and Operation

Starter Motor Operation (Without KL9)

The starter motors are non-repairable. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding because battery voltage is applied to both ends of the windings. The hold-in winding remains energized. Its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened.

When the crank signal is removed, the starter relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, causes the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Enhanced Starter Motor Operation (KL9)

The Engine Stop/Start system in GM vehicles automatically turns off the engine when the vehicle comes to a stop under certain driving conditions, and can quickly restart the engine in about 0.3 seconds when commanded to do so.

In order to smoothly restart the engine as quickly as possible while managing the greater number of engine starts, the Stop/Start system uses an enhanced starter motor that operates differently from a conventional starter motor. It has a high performance electric motor and a stronger pinion engagement mechanism than a conventional starter. It also has independent control of the pinion and motor.

The enhanced starter motor continues using the typical pinion engagement mechanism with a starter solenoid that drives the pinion gear to engage or disengage the flywheel of the engine. When engaged, the starter motor can rotate the engine flywheel and, in turn, the crankshaft.

On the enhanced starter of a Stop/Start system the operation is done in two separate functions inside the solenoid, Starter Motor and Pinion Actuator. Each function controlled individually by the ECM. There are two separate relays to control the two separate parts of the enhanced solenoid:

- KR27 Starter Motor Relay
- KR27C Starter Pinion Actuator Relay

The two individually-controlled relays allow for smooth engagement of the pinion gear into the flywheel with minimum noise and wear.

When the vehicle is coming to a stop, just before the engine stops rotating (at approximately 50 RPM) during stop/start operation, the ECM energizes the Starter Pinion Solenoid Actuator Relay to easily push the pinion gear into the flywheel gear without gear clash. (Fig. 8) When the engine stops rotating during Stop/Start operation (Auto Stop mode), the starter pinion gear is fully engaged, ready for the starter motor to become energized to quickly start the engine again.

A secondary need for the starter pinion to be driven into the flywheel gear before the engine stops rotating is to address quickly changing demands on the engine. For example, when a driver is slowing nearly to a stop — and the Stop/Start system is preparing for Auto Stop mode — but suddenly decides to release the brake and accelerate

In this situation, the engine has already stopped rotating, or nearly so. A conventional starter cannot restart the engine until the engine has completely stopped. However, with the enhanced starter, the starter pinion gear is fully engaged and ready to begin rotating the engine even before it fully stops turning. Otherwise, the engine would actually have to stop rotating before the pinion can engage smoothly to begin a restart.

To prevent a lag in engine operation, the ECM uses predictive speed matching of the flywheel gear speed and the pinion gear speed to engage the pinion gear into the flywheel gear without gear clash before the engine fully stops. By predicting how long it takes the starter motor to spin up using an algorithm, the pinion gear speed can be matched to the flywheel gear speed. The result is an almost instant restart that is possible at extremely low engine speeds.

Circuit Description

Keyless Start

When the Ignition mode switch is placed in the crank position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the crank position. The BCM then sends a serial data message to the engine control module (ECM) that crank has been requested. The ECM then verifies that the clutch is fully depressed or the automatic transmission is in Park/Neutral. If it is, the ECM then supplies 12 V to the control circuit of the starter relay. When this occurs, battery positive voltage is supplied through the switch side of the crank relay to the S terminal of the starter solenoid.

Key Start

When the ignition switch is placed in the Start position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the Start position. The BCM then sends a message to the engine control module (ECM) notifying it that CRANK has been requested. The ECM verifies that the transmission is in Park or Neutral. If it is, the ECM then supplies 12 V to the control circuit of the crank relay. When this occurs, battery positive voltage is supplied through the switch side of the crank relay to the S terminal of the starter solenoid.

Section 5

HVAC

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Air Delivery Description and Operation 5-16
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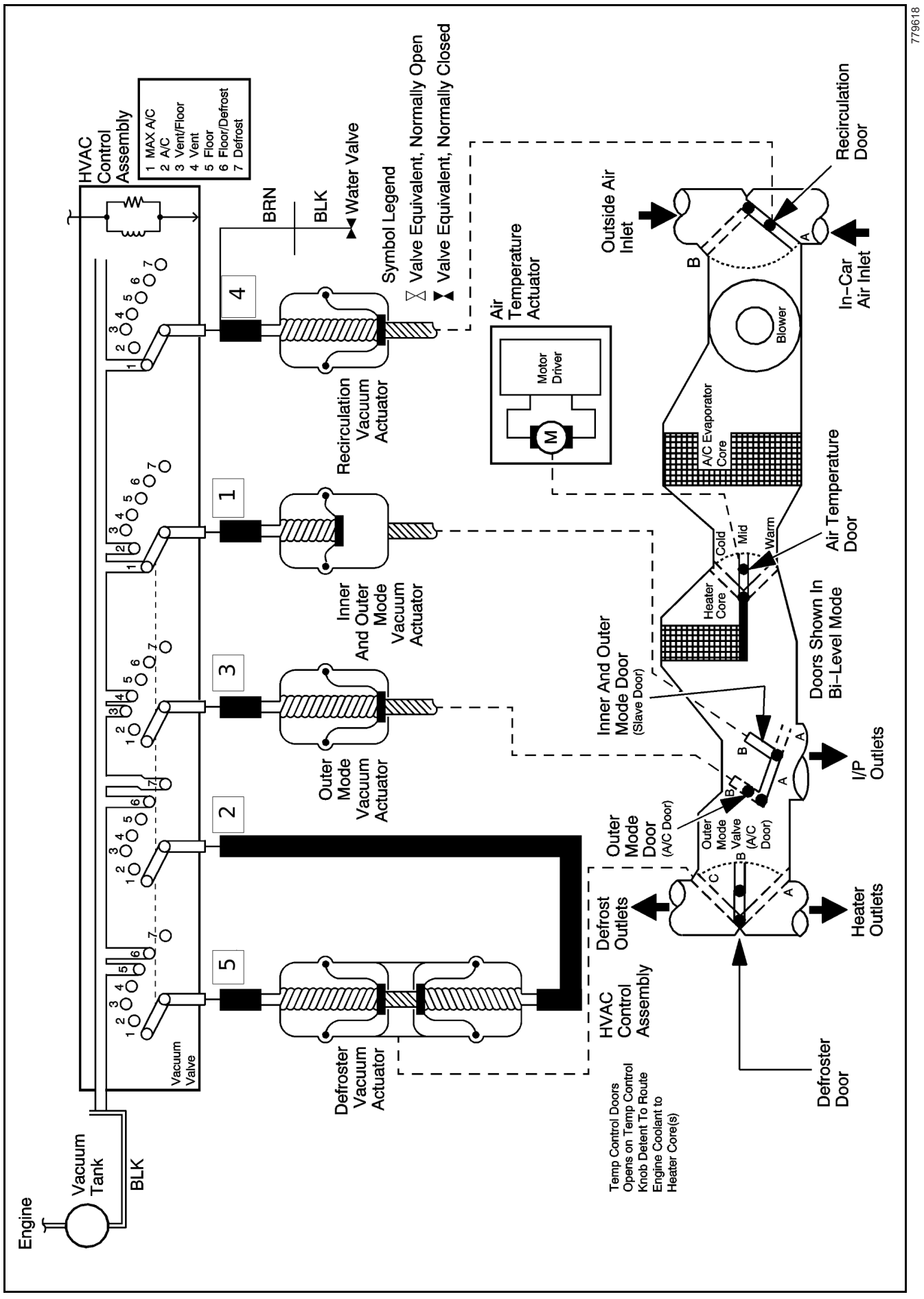
HVAC - Manual

Schematic and Routing Diagrams


HVAC Vacuum Schematics (Vacuum System Control Schematic)
779618
HVAC Control Assembly
1 MAX A/C
2 A/C
3 Vent/Floor
4 Vent
5 Floor
6 Floor/Defrost
7 Defrost
BRN
BLK
Water Valve
Symbol Legend
Valve Equivalent, Normally Open
Valve Equivalent, Normally Closed
Air Temperature Actuator
Motor Driver
Recirculation Vacuum Actuator
Inner And Outer Mode Vacuum Actuator
Outer Mode Vacuum Actuator
Defroster Vacuum Actuator
Vacuum Valve
Vacuum Tank
Engine
BLK
Outside Air Inlet
Recirculation Door
In–Car Air Inlet
Blower
A/C Evaporator Core
Heater Core
Cold
Mid
Warm
Air Temperature Door
Inner And Outer Mode Door (Slave Door)
Doors Shown In Bi–Level Mode
Outer Mode Door (A/C Door)
Outer Mode Valve (A/C Door)
I/P Outlets
Defrost Outlets
Heater Outlets
Defroster Door
HVAC Control Assembly
Temp Control Doors Opens on Temp Control Knob Detent To Route Engine Coolant to Heater Core(s)

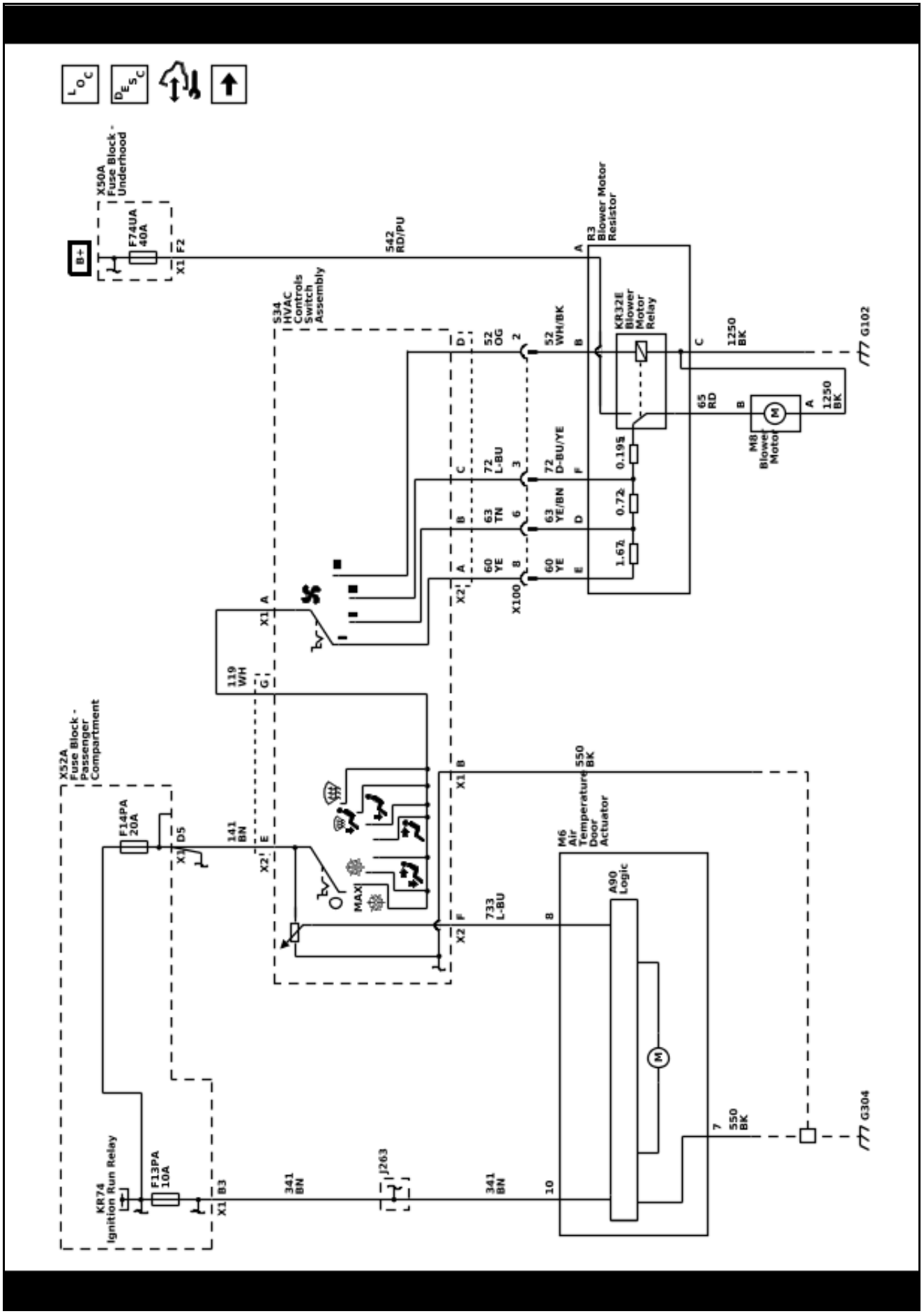
Heater Only

Vacuum Valve Switch Operating Chart							
Vacuum Hose Connector	**Port Number**	**Off**	**Vent**	**Bi- Level**	**Heat**	**Blend**	**Defrost**
A/C Open	1	Vent	Vacuum	Vent	Vent	Vent	Vent
Defrost	2	Vent	Vent	Vent	Vent	Vent	Vacuum
Bi- Level	3	Vent	Vacuum	Vacuum	Vent	Vent	Vent
Recirculation	4	Vent	Vent	Vent	Vent	Vent	Vent
Heater	5	Vacuum	Vent	Vacuum	Vacuum	Vent	Vent
Vacuum Source	6	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum

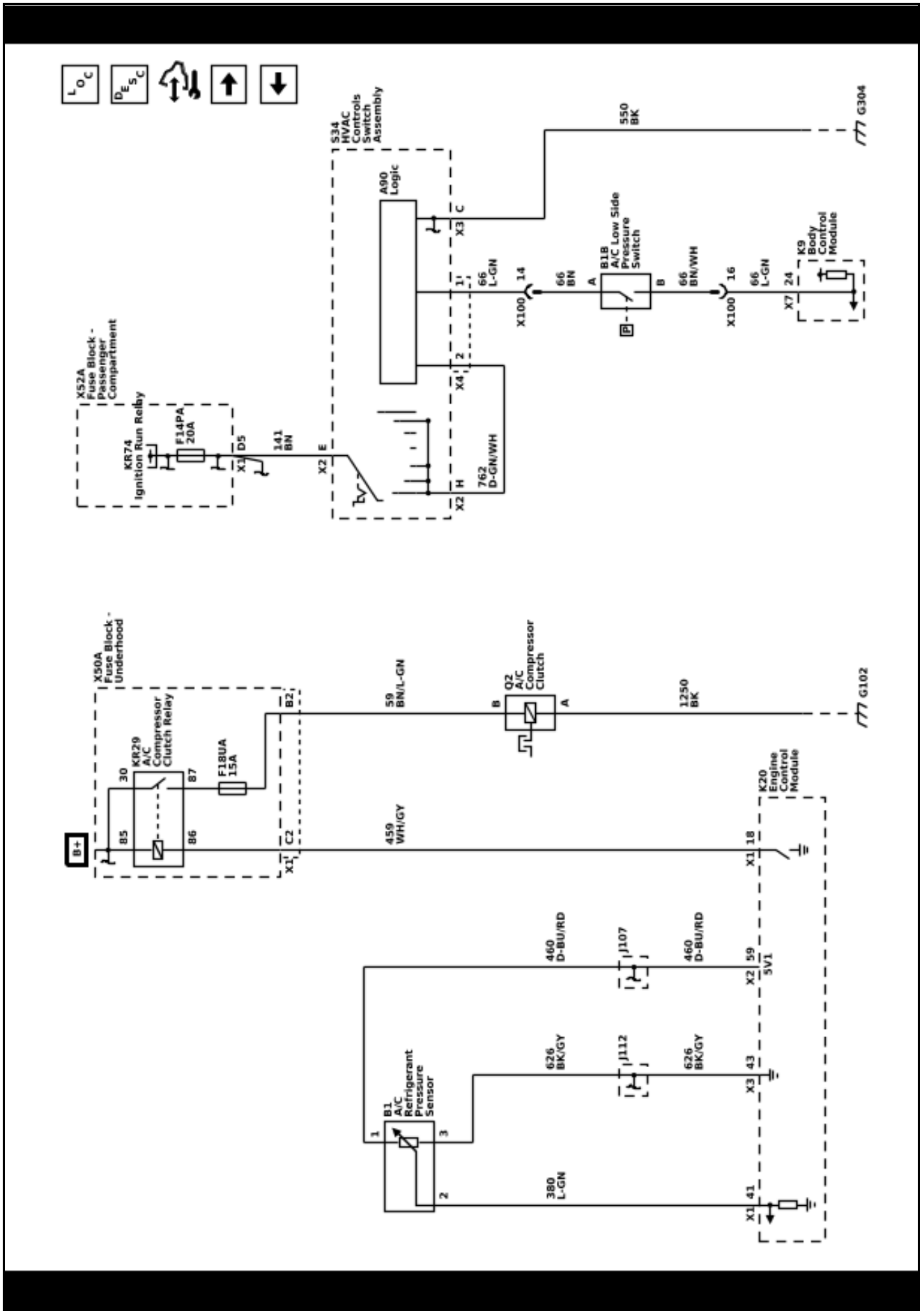
Heater and Air Conditioning

Vacuum Valve Switch Operating Chart									
Vacuum Hose Connec-tor	**Port Number**	**Off**	**MAX**	**Normal**	**Bi- Level**	**Vent**	**Heat**	**Blend**	**Defrost**
A/ C Open	1	Vent	Vacuum	Vacuum	Vent	Vacuum	Vent	Vent	Vent
Defrost	2	Vent	Vent	Vent	Vent	Vent	Vent	Vent	Vacuum
Bi- Level	3	Vent	Vacuum	Vacuum	Vacuum	Vacuum	Vent	Vent	Vent
Recircu-lation	4	Vent	Vacuum	Vent	Vent	Vent	Vent	Vent	Vent
Heater	5	Vacuum	Vent	Vent	Vacuum	Vent	Vacuum	Vent	Vent
Vacuum Source	6	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum

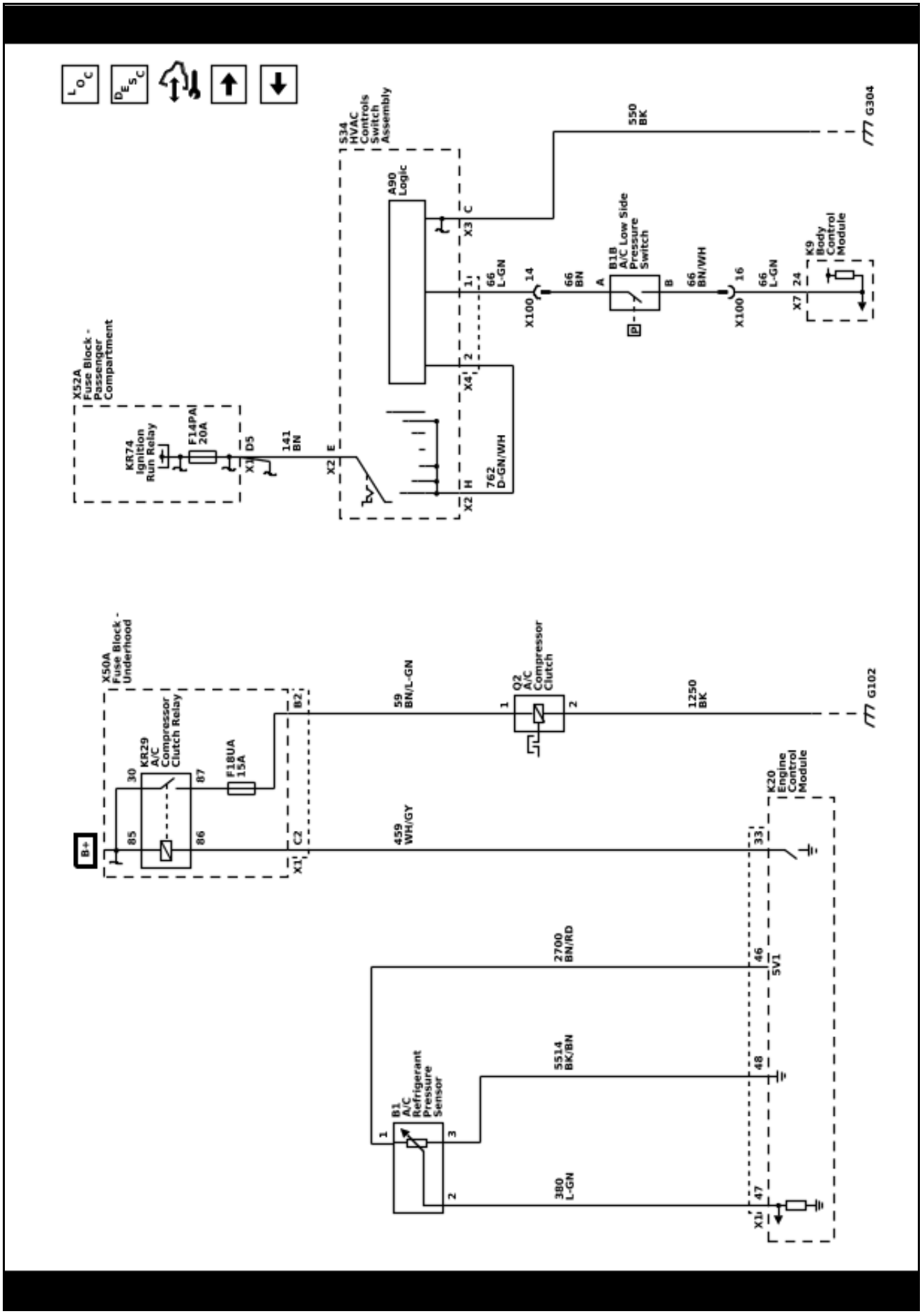
HVAC Schematics (Front Air Delivery Controls and Front Blower Motor)



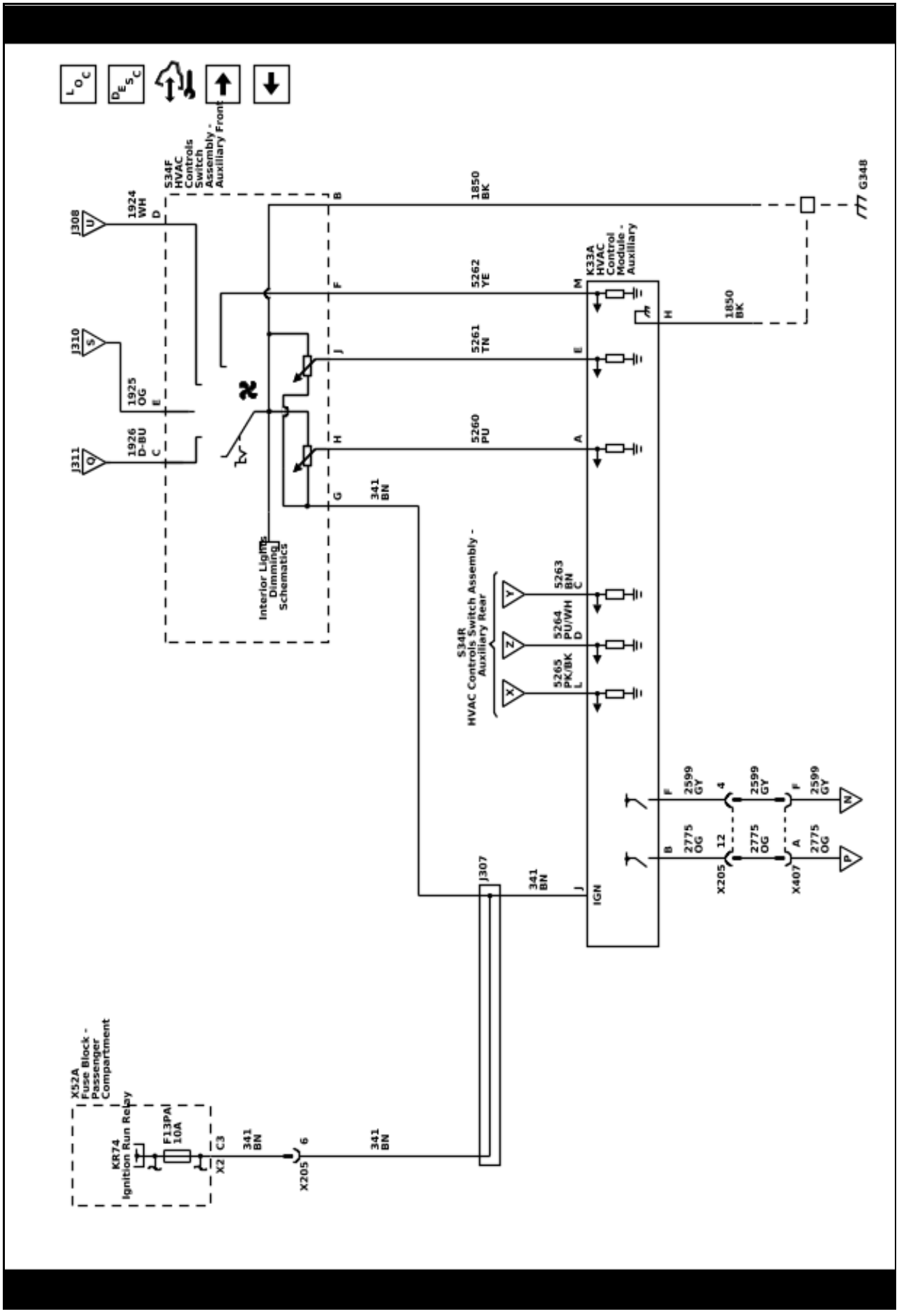
HVAC Schematics (Compressor Controls (C60-LWN))



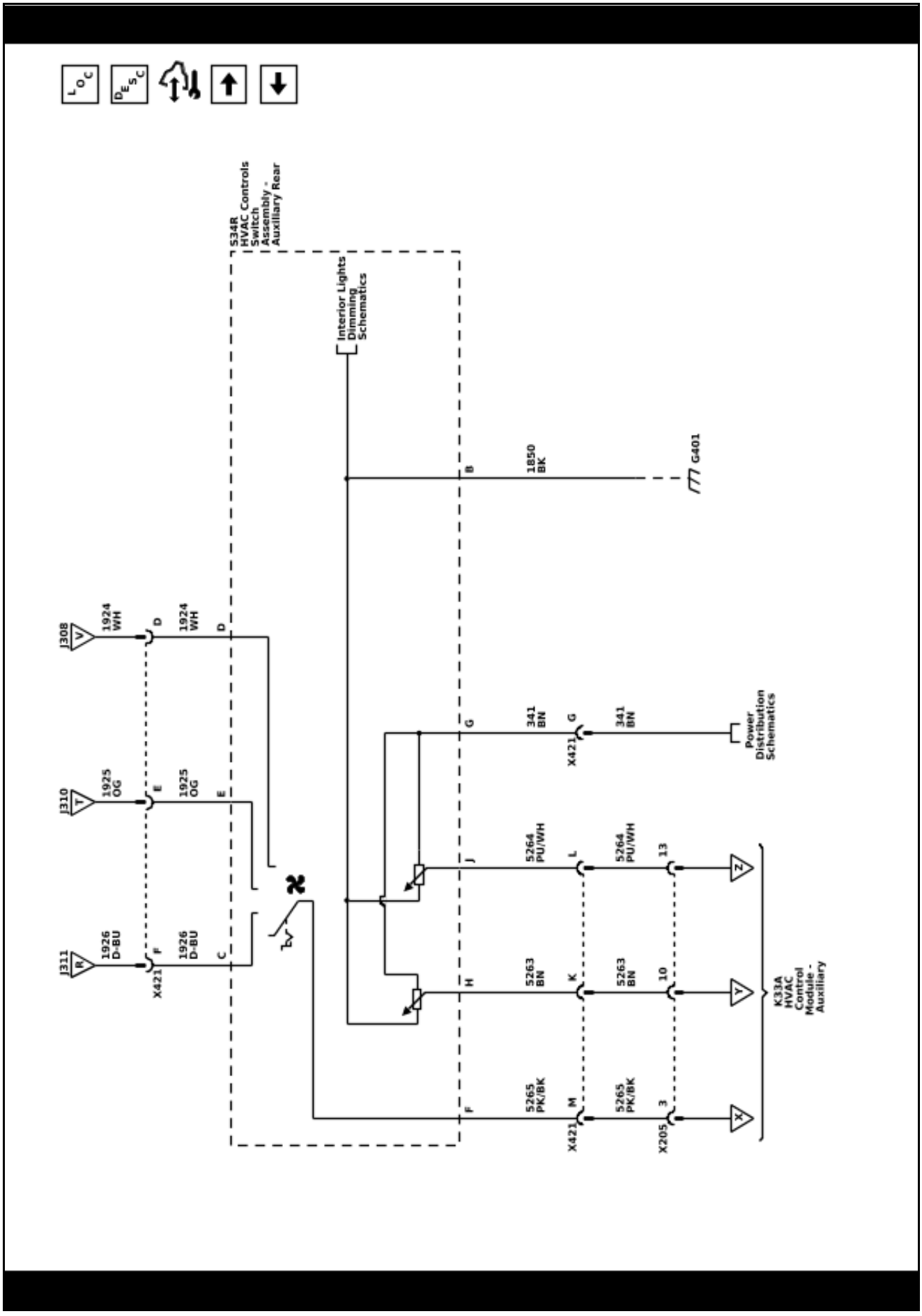
HVAC Schematics (Compressor Controls (C60+LWN))



HVAC Schematics (Rear HVAC with Rear Air Conditioning (C69), with Rear HVAC Controls - Air Delivery Controls)



HVAC Schematics (Rear HVAC with Rear Air Conditioning (C69), with Rear HVAC Controls - Rear Controls)



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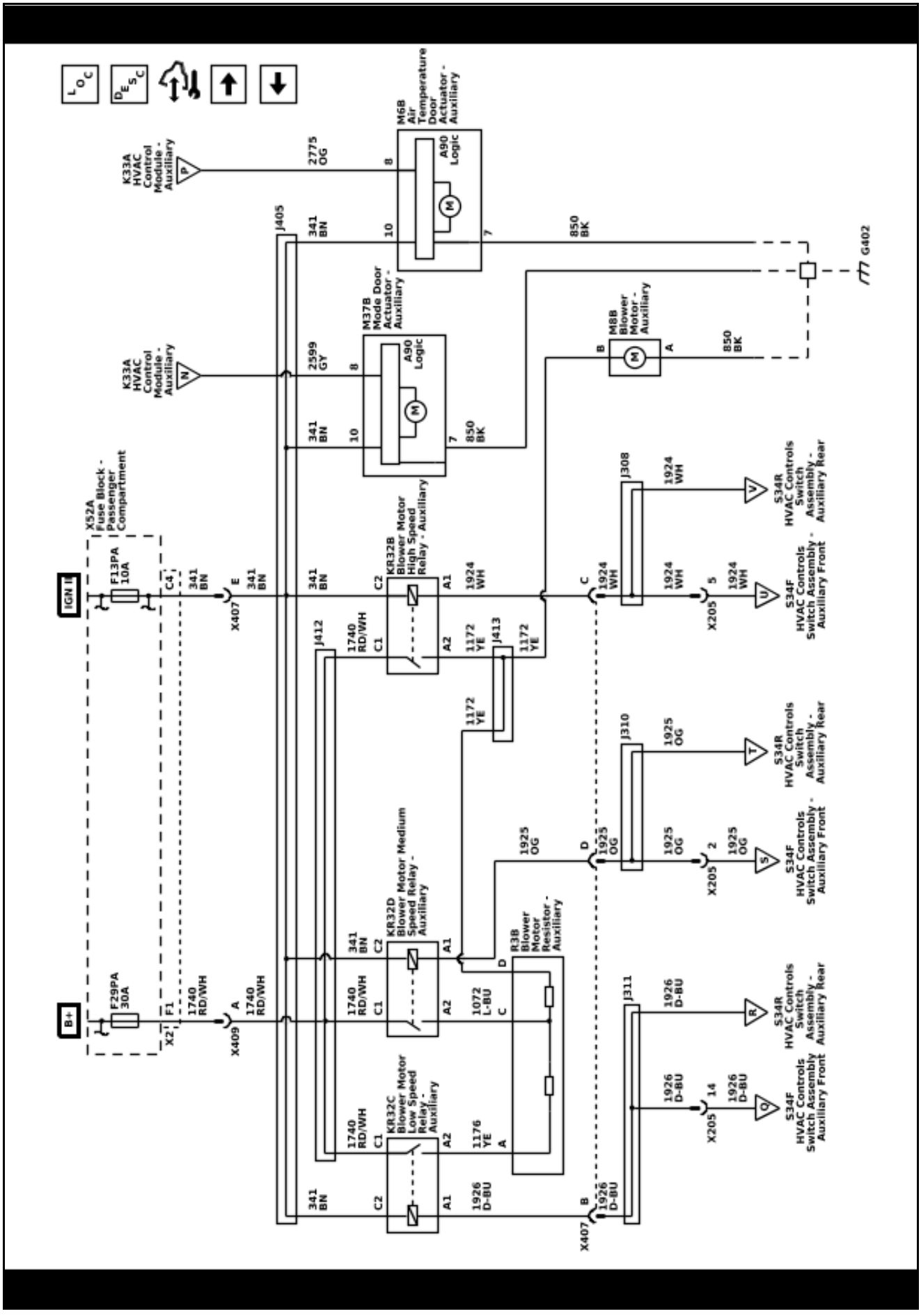
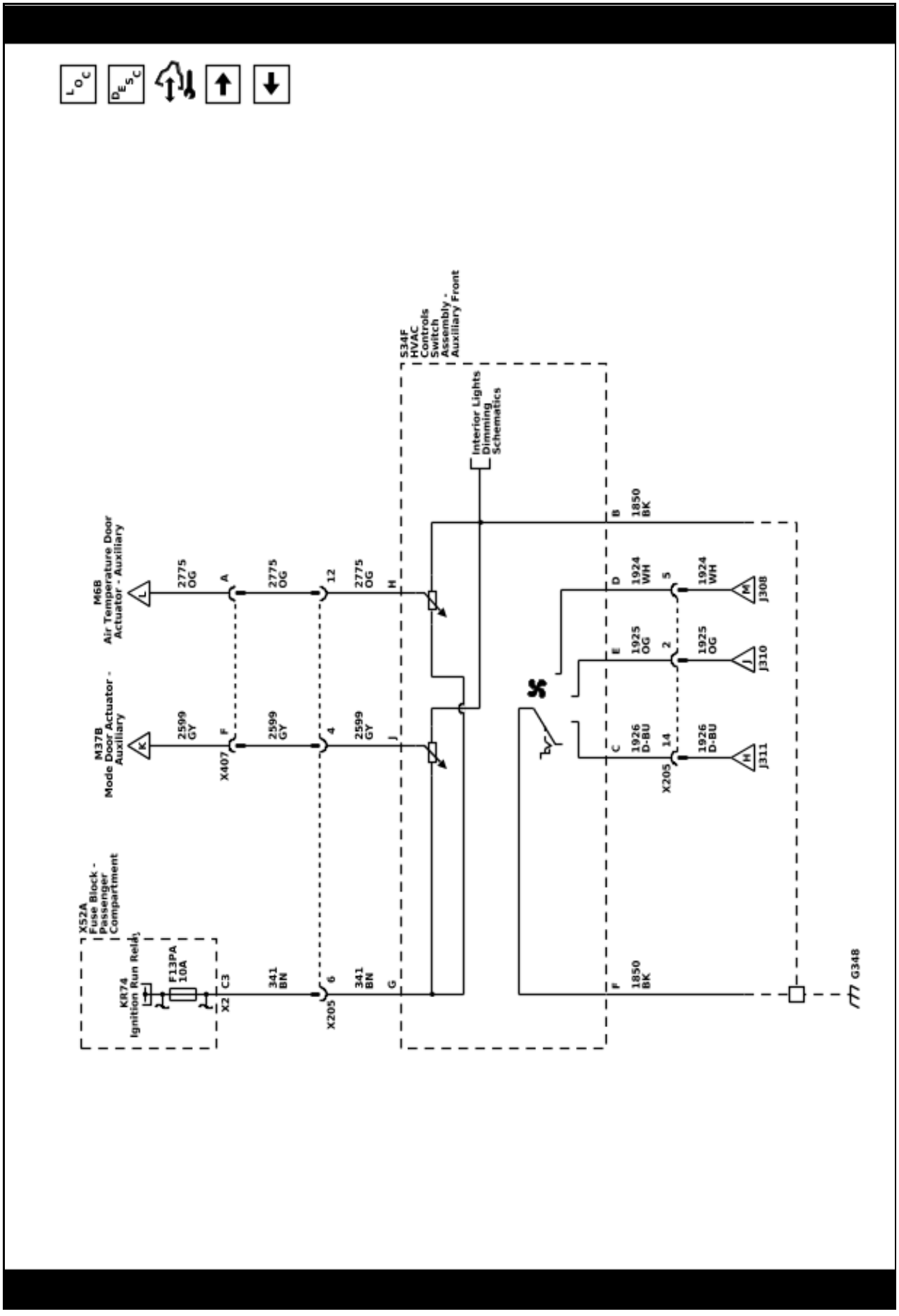
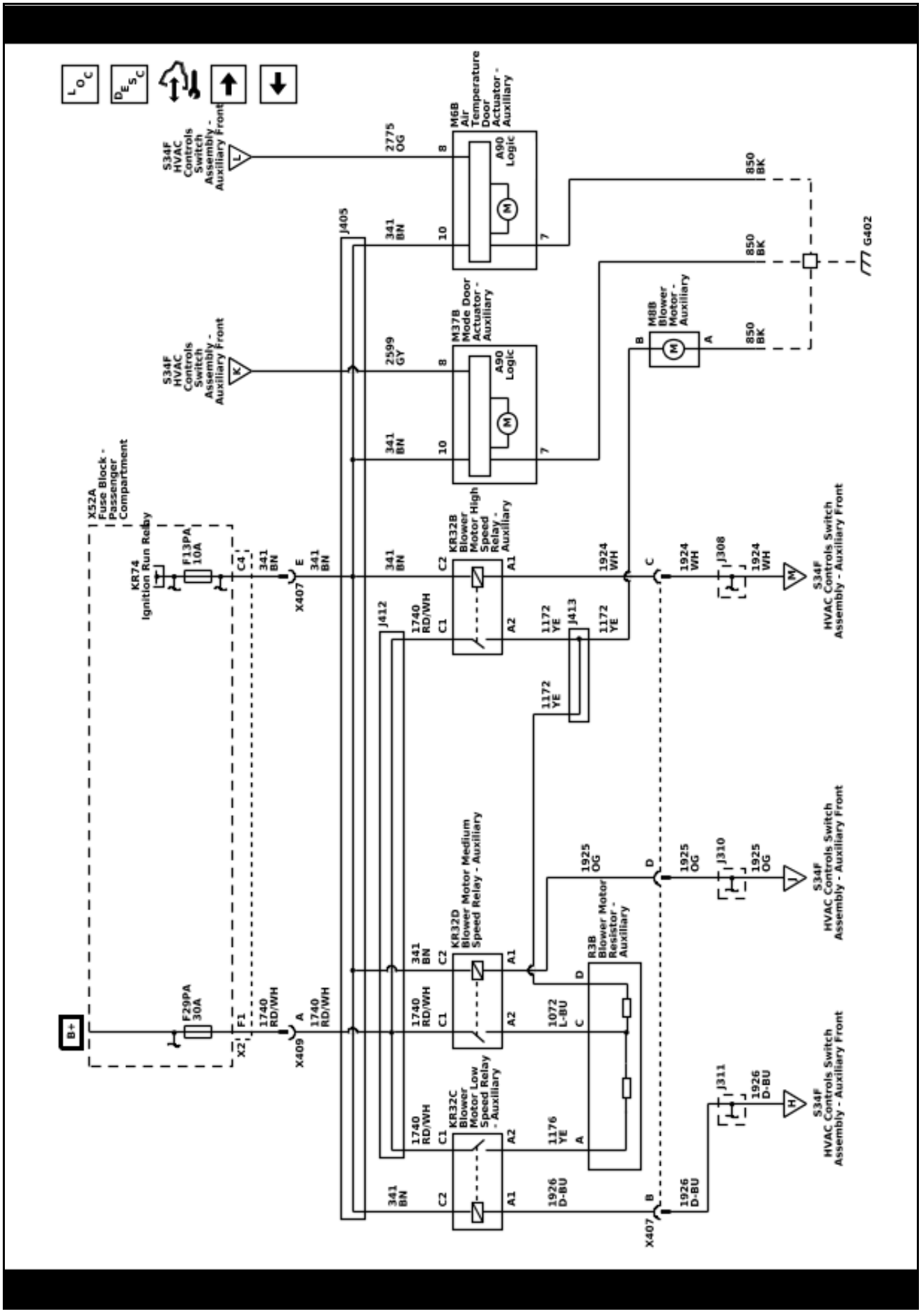
HVAC Schematics (Rear HVAC with Rear Air Conditioning (C69), with Rear HVAC Controls - Front Controls)



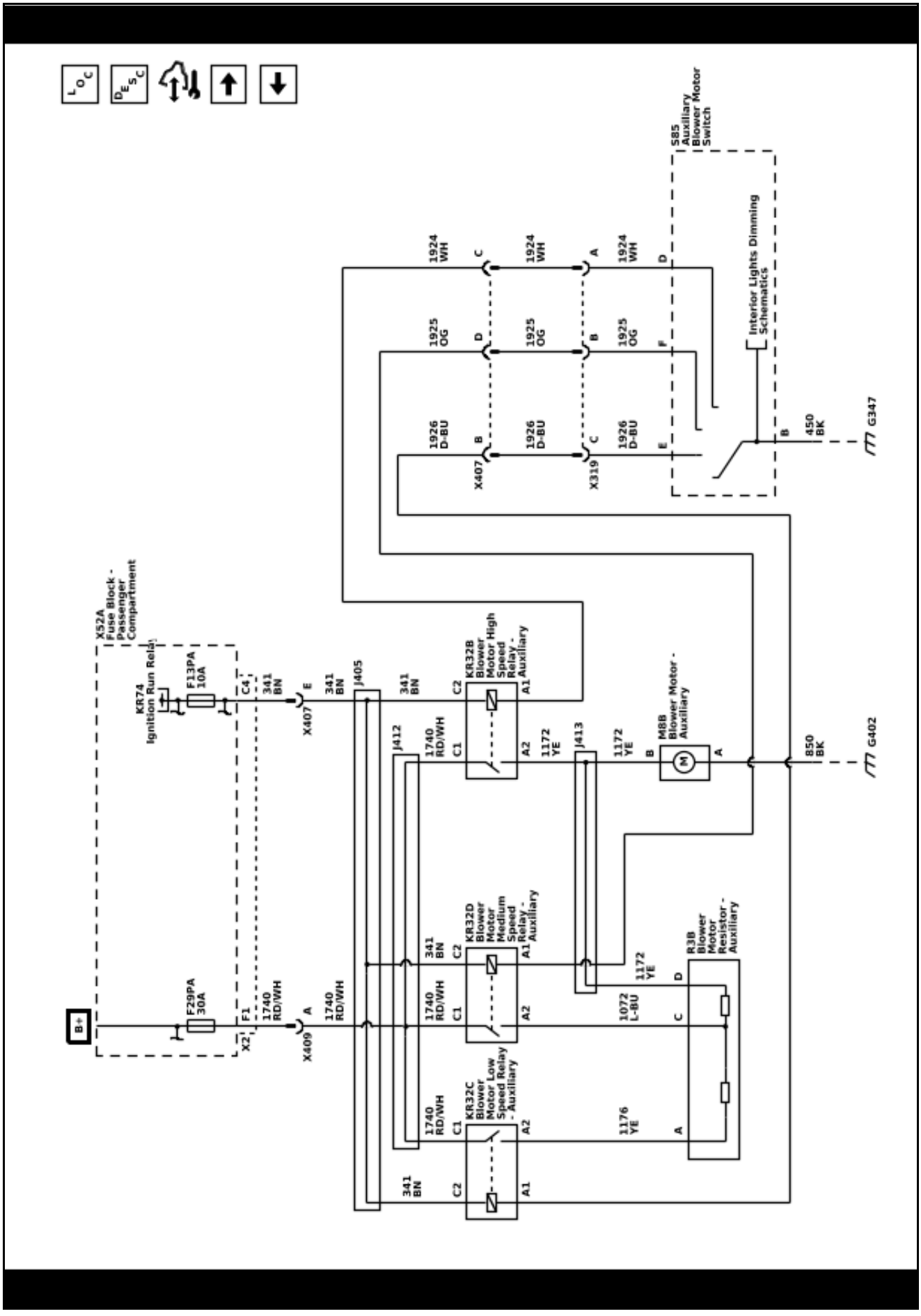
HVAC Schematics (Rear HVAC with Rear Air Conditioning (C69), without Rear HVAC Controls - Air Delivery Controls)



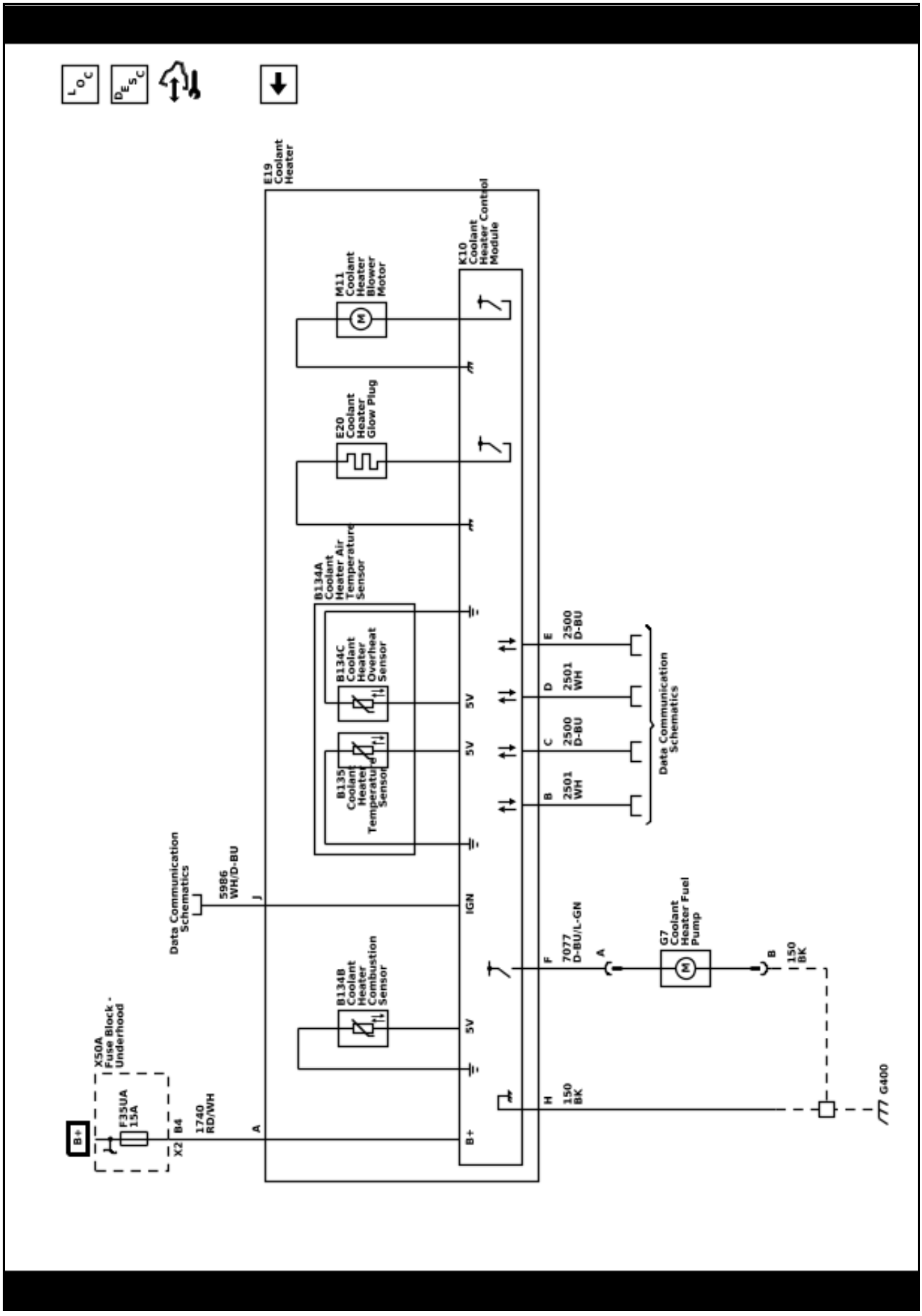
HVAC Schematics (Rear HVAC with Rear Air Conditioning (C69), without Rear HVAC Controls - Front Controls)



HVAC Schematics (Rear HVAC without Rear Air Conditioning (C36 without C69))



HVAC Schematics (Coolant Heater (K08))



Description and Operation

Air Delivery Description and Operation

The air delivery description and operation is divided into the following:

- HVAC Control Assembly
- Air Speed
- Auxiliary Air Speed
- Air Distribution
- Auxiliary Air Delivery

HVAC Control Assembly

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. The ignition 3 voltage circuit provides power to the control assembly. Two integrated potentiometers control air temperature door position and blower motor speed. The integrated vacuum system controls the position of the mode doors.

Air Speed

The HVAC control assembly applies voltage to the blower motor control circuit that corresponds to the selected blower speed. The resistors and the blower motor are in a series circuit. The following list represents the number of resistors in series with the blower motor per particular speed request:

- Low speed-3 resistors
- Medium 1 speed-2 resistors
- Medium 2 speed-1 resistor

When the operator requests High speed, the HVAC control assembly applies voltage to the blower motor relay through the high blower motor control circuit. The voltage energizes the blower motor relay, connecting the blower motor to battery positive voltage.

Auxiliary Air Speed

The auxiliary HVAC control assembly applies voltage to the auxiliary blower motor control circuit that corresponds to the selected blower speed. The resistors and the blower motor are in a series circuit. The following list represents the number of resistors in series with the blower motor per particular speed request:

- Low speed-2 resistors
- Medium speed-1 resistor

When the operator requests High speed, the HVAC control assembly applies voltage to the blower motor relay through the auxiliary high blower motor control circuit. The voltage energizes the blower motor relay, connecting the blower motor to battery positive voltage.

Air Distribution

The HVAC control assembly uses vacuum to control the mode door position. Vacuum is supplied to the control assembly and a vacuum tank by either an engine vacuum source, or a vacuum pump when the vehicle is equipped with a diesel engine..

Vacuum Pump (Diesel Engines)

The mechanical vacuum pump operates when the engine is running. The vacuum pump supplies vacuum to the HVAC control assembly and vacuum tank.

Mode Switch

The mode switch is a rotary vacuum valve that directly applies vacuum to the appropriate vacuum actuator. Use the mode switch to change the air delivery mode in the vehicle.

MAX A/C (If Equipped)

The mode switch applies vacuum to ports 1, 3, and 4. The mode actuators have vacuum applied to them, directing airflow to the vents. The recirculation actuator has vacuum applied to it positioning the recirculation door to recirculate air within the vehicle. A/C compressor operation is requested.

A/C (If Equipped)

The mode switch applies vacuum to ports 1 and 3. The mode actuators have vacuum applied to them, directing airflow to the vents. A/C compressor operation is requested.

Bi-Level Mode

The mode switch applies vacuum to ports 3 and 5. The inner mode and defrost actuators have vacuum applied to them, directing airflow to the vents and floor.

Vent Mode

The mode switch applies vacuum to ports 1 and 3. The mode actuators have vacuum applied to them, directing airflow to the vents.

Floor Mode

The mode switch applies vacuum to port 5. The defrost actuator has vacuum applied to it, directing airflow to the floor.

Mix-Blend Mode

The mode switch vents all ports. With no vacuum at any port, the following occurs:

- Vacuum is bled off the defrost actuator, keeping it in a neutral position. The defroster door is held stationary in the half-open directing airflow through the defroster and floor outlets.
- A/C compressor operation is requested.

Defrost Mode

The mode switch applies vacuum to port 7 and the following occurs:

- The defrost actuator has vacuum applied to it directing airflow through the defroster outlet.
- A/C compressor operation is requested.

Auxiliary Air Distribution (C69)

Auxiliary HVAC Control Processor

The auxiliary HVAC control processor controls all outputs for the auxiliary HVAC system. The auxiliary HVAC control processor receives inputs from the front and rear auxiliary HVAC control assemblies. The auxiliary HVAC control processor does not utilize Class 2 communications. If the auxiliary HVAC control processor receives a 12V varied voltage input for an

auxiliary air temperature actuator change request. Then the auxiliary HVAC control processor creates a 12V varied output for control of the auxiliary air temperature actuator.

Auxiliary Mode Actuator

The auxiliary mode actuator is a 3 wire bi-directional electric motor. Ignition 3 voltage, ground and control circuits enable the actuator to operate. The control circuit uses a 0-12V linear-ramped signal to command the actuator movement. The 0 and 12V control values represent the opposite limits of the actuator range of motion. The values in between 0 and 12V correspond to the positions between the limits. When the HVAC control assembly sets a commanded, or targeted, value, the control signal is set to a value between 0-12V. The actuator shaft rotates until the commanded position is reached. The module will maintain the control value until a new commanded value is needed.

The rear auxiliary air delivery and the temperature controls work independently of the ventilation controls used for the front of the vehicle. The rear auxiliary mode door and the rear auxiliary temperature door are exclusively controlled from either of the 2 auxiliary HVAC controls. The front auxiliary HVAC controls has a permissive position called REAR. The REAR position enables control from the rear auxiliary HVAC controls.

Air Temperature Description and Operation

The air temperature controls are divided into five areas.

- HVAC Control Components
- Heating and A/C Operation
- Auxiliary Heating and A/C Operation
- Engine Coolant
- A/C Cycle

HVAC CONTROL COMPONENTS

HVAC Control Assembly

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. The ignition 3 voltage circuits provide power to the control assembly. Two integrated potentiometers control air temperature door position and blower motor speed. The integrated vacuum system controls the mode door position.

Auxiliary HVAC Control Processor

The auxiliary HVAC control processor controls all outputs for the auxiliary HVAC system. The auxiliary HVAC control processor receives inputs from the front and rear auxiliary HVAC control assemblies. The auxiliary HVAC control processor does not utilize Class 2 communications.

If the auxiliary HVAC control processor receives a 12-volt varied voltage input for an auxiliary air temperature actuator change request. Then the auxiliary HVAC control processor creates a 12-volt varied output for control of the auxiliary air temperature actuator.

Air Temperature Actuator

The air temperature actuator and auxiliary air temperature actuator are a 3-wire bi-directional electric motor. Ignition 3 voltage, ground and control circuits enable the actuator to operate. The control circuit uses a 0–12-volt linear-ramped signal to command the actuator movement. The 0 and 12-volt control values represent the opposite limits of the actuator range of motion. The values in between 0 and 12 volts correspond to the positions between the limits.

When the HVAC control assembly sets a commanded, or targeted, value, the control signal is set to a value between 0–12 volts. The actuator shaft rotates until the commanded position is reached. The module will maintain the control value until a new commanded value is needed.

A/C Pressure Switches

The A/C system is protected by two A/C pressure switches.

- A/C low pressure switch
- A/C high pressure switch

The A/C high pressure switch interrupts the A/C request signal when the A/C line pressure is more than a predetermined value. The A/C low pressure switch interrupts the A/C low pressure switch signal when the A/C line pressure is less than or more than a predetermined value. When the powertrain control module (PCM) stops receiving the required signals, the A/C compressor clutch relay control circuit is no longer grounded, disengaging the A/C compressor clutch. The A/C compressor clutch is disengaged under the following conditions:

- A/C low pressure switch is less than 152 kPa (22 psi).
- A/C low pressure switch is more than 310 kPa (45 psi).
- A/C high pressure switch is more than 2896 kPa (420 psi).

Bypass Valves

The bypass valves included in the air temperature system are:

- Coolant Bypass Valve
- Hot Water Bypass Valve

The bypass valve is a normally open valve, which closes when vacuum is applied to the valve. When the MAX A/C mode is selected, vacuum from the HVAC control assembly is applied to the bypass valve. The vacuum must be strong enough to overcome the tension of the valve's internal return spring in order to close the bypass valve. The return spring forces the valve to return to the open position, when any of the other HVAC modes are selected. In the closed position, the flow of coolant to the heater core is bypassed, allowing maximum cooling to the passenger compartment.

Heating and A/C Operation

The purpose of the heating and A/C system is to provide heated and cooled air to the interior of the vehicle. The A/C system will also remove humidity from the interior and reduce windshield fogging. The vehicle operator can determine the passenger compartment

temperature by adjusting the air temperature switch. Regardless of the temperature setting, the following can effect the rate that the HVAC system can achieve the desired temperature:

- Recirculation
- Difference between inside and desired temperature
- Difference between ambient and desired temperature
- Blower motor speed setting
- Mode setting
- Auxiliary HVAC settings

The A/C system can be engaged by placing the mode switch in one of the following positions:

- Max A/C
- A/C
- Bi-Level
- Blend
- Defrost

The A/C system can operate regardless of the temperature setting. Regardless of the selected A/C mode setting, a request is sent to the PCM to turn on the A/C compressor clutch.

The following conditions must be met in order for the PCM to turn on the compressor clutch:

- Ambient air temperature is greater than 3°C (38°F)
- Engine coolant temperature (ECT) is less than 123°C (253°F)
- Engine speed is less than 5000 RPM
- The A/C compressor cycling switch pressure is between 124-388 kPa (18-49 psi)
- The A/C high pressure cutout switch is less than 2896 kPa (420 psi)

Once engaged, the compressor clutch will be disengaged for the following conditions:

- Throttle position is 100 percent
- The A/C compressor cycling switch pressure is less than 124 kPa (18 psi) or more than 338 kPa (49 psi)
- The A/C high pressure cutout switch is more than 2896 kPa (420 psi)
- Engine coolant temperature (ECT) is more than 123°C (253°F)
- Engine speed is more than 5000 RPM
- Transmission shift
- PCM detects excessive torque load
- PCM detects insufficient idle quality
- PCM detects a hard launch condition

When the compressor clutch disengages, the compressor clutch diode protects the electrical system from a voltage spike.

Heater Mode – Auxiliary Heater without A/C

The auxiliary blower motor recycles air from the vehicle's interior. The vehicle operator can determine the intensity of the auxiliary heater by placing the auxiliary blower motor in one of the following positions:

- Low
- Med
- High

Since there is no temperature switch, the temperature is controlled by the speed of the auxiliary blower motor. The auxiliary blower motor will only operate when the ignition is in the RUN position, and the auxiliary blower motor switch is in any position other than OFF.

Heater Mode – Front Auxiliary HVAC Control Assembly Only

The auxiliary temperature switch in the front auxiliary HVAC control assembly allows the vehicle operator to adjust the temperature in the rear of the vehicle. Power is provided to both the front auxiliary HVAC control assembly and the auxiliary air temperature actuator from the instrument panel (I/P) fuse block on the ignition 3 voltage circuit.

Voltage delivered to the front auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a variable resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature.

Heater Mode – Front Auxiliary HVAC Control Assembly with Rear Auxiliary HVAC Control Assembly

The auxiliary temperature switch in the front auxiliary HVAC control assembly allows the vehicle operator to adjust the temperature in the rear of the vehicle. Power is provided to both the front auxiliary HVAC control assembly and the auxiliary air temperature actuator from the (I/P) fuse block on the ignition 3 voltage circuit.

Voltage delivered to the front auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a varied resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit, and auxiliary HVAC control processor. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature

Heater Mode – Rear Auxiliary HVAC Control Assembly

The auxiliary temperature switch in the rear auxiliary HVAC control assembly allows the rear seat passengers to adjust the temperature in the rear of the vehicle. Power is provided to the rear auxiliary HVAC control assembly, auxiliary HVAC control processor and the auxiliary air temperature actuator from the (I/P) fuse block on the ignition 3 voltage circuit.

To activate the rear auxiliary HVAC control assembly, the front auxiliary HVAC control assembly must be placed in the REAR CNTL position. Ignition 3 voltage is

sent to the auxiliary HVAC control processor. When the switch is placed in the REAR CNTL position, the voltage is grounded through the auxiliary blower motor switch control, front auxiliary HVAC control assembly and the ground circuit to allow the rear auxiliary HVAC control assembly to operate the auxiliary temperature actuator. Voltage delivered to the rear auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a variable resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit, and auxiliary HVAC control processor. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature.

A/C Mode – Front Auxiliary HVAC Control Assembly Only

The auxiliary temperature switch in the front auxiliary HVAC control assembly allows the vehicle operator to adjust the temperature in the rear of the vehicle. Power is provided to both the front auxiliary HVAC control assembly and the auxiliary air temperature actuator from the (I/P) fuse block on the ignition 3 voltage circuit.

Voltage delivered to the front auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a variable resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature.

A/C Mode – Front Auxiliary HVAC Control Assembly with Rear Auxiliary HVAC Control Assembly

The auxiliary temperature switch in the front auxiliary HVAC control assembly allows the vehicle operator to adjust the temperature in the rear of the vehicle. Power is provided to both the front auxiliary HVAC control assembly and the auxiliary air temperature actuator from the (I/P) fuse block on the ignition 3 voltage circuit.

Voltage delivered to the front auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a variable resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit, and auxiliary HVAC control processor. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature.

A/C Mode – Rear Auxiliary HVAC Control Assembly

The auxiliary temperature switch in the rear auxiliary HVAC control assembly allows the rear seat passengers to adjust the temperature in the rear of the vehicle. Power is provided to the rear auxiliary HVAC control assembly, auxiliary HVAC control processor and the auxiliary air temperature actuator from the (I/P) fuse block on the ignition 3 voltage circuit.

To activate the rear auxiliary HVAC control assembly, the front auxiliary HVAC control assembly must be placed in the REAR CNTL position. Ignition 3 voltage is sent to the auxiliary HVAC control processor. When the switch is placed in the REAR CNTL position, the voltage is grounded through the auxiliary blower motor switch control, front auxiliary HVAC control assembly and the ground circuit to allow the rear auxiliary HVAC control assembly to operate the auxiliary temperature actuator. Voltage delivered to the rear auxiliary HVAC control assembly on the ignition 3 voltage circuit is sent to a varied resistor. Based on the placement of the temperature switch, a varied voltage is sent to the auxiliary air temperature actuator on the auxiliary air temperature door control circuit, and auxiliary HVAC control processor. The auxiliary air temperature actuator positions the temperature door to divert the appropriate amount of air past the heater core in order to achieve the desired temperature.

Engine Coolant

Engine coolant is the key element of the heating system. The thermostat controls engine operating coolant temperature. The thermostat also creates a restriction for the cooling system that promotes a positive coolant flow and helps prevent cavitation. Coolant enters the heater core through the inlet heater hose, in a pressurized state.

The heater core is located inside the HVAC module. The heat of the coolant flowing through the heater core is absorbed by the ambient air drawn through the HVAC module. Heated air is distributed to the passenger compartment, through the HVAC module, for passenger comfort.

The amount of heat delivered to the passenger compartment is controlled by opening or closing the HVAC module air temperature door. The coolant exits the heater core through the return heater hose and recirculated back through the engine cooling system.

Coolant Heater (K08)

The coolant heater function is to provide additional heat to the passenger compartment. The coolant heater burns diesel fuel, to heat up the engine coolant when the vehicle is running and will only operate during conditions where ambient temperature is below 4°C (39°F) and a fuel tank level greater than 12.5 percent. The heat of the hot engine coolant is transferred to the HVAC module to heat the passenger compartment. The coolant heater does not heat up instantly. It must go through a self test and start up procedure before normal operation. The vehicle must be running to start the unit but after the unit is no longer commanded on a two minute shut down (purge) procedure starts. The coolant flow is from the engine to the fuel operated heater through the heat exchanger back to the engine.

Battery voltage and ground is supplied to the coolant heater. The electronic control unit inside the coolant heater determines when the unit will turn ON and OFF as well as how it will function. The electronic control unit also uses GMLAN communication and the engine control module (ECM) to transfer coolant heater information that the scan tool can read. The fuel operated heater contains flame sensors to disable the glow plug once the flame is established or to abort the startup attempt if the flame is not established.

Inputs to the coolant heater electronic control unit:

- Coolant sensor
- Overheat sensor

- Combustion sensor
- GMLAN ECM

Outputs from the coolant heater electronic control unit:

- Fuel pump
- Glow plug
- Blower motor
- GMLAN ECM

The coolant heater controls the coolant temperature with 3 operating modes.

- HIGH—If coolant temperature is in a range between −40 to +75°C (−40 to +176°F), the coolant heater fuel pump will pump fuel at maximum capacity to increase the coolant temperature as fast as possible. Note: Ambient temperature must be below 4°C (39°F), fuel tank level greater than 12.5 percent and the engine should be running.
- LOW—If coolant temperature is in a range between 85–90°C (185–194°F), the coolant heater fuel pump will pump fuel at minimum capacity to increase the coolant temperature at a slower rate.
- OFF—If coolant temperature is above 90°C (195° F), the coolant heater fuel pump will stop pumping fuel and allow the remaining fuel in the combustion chamber to burn out. The coolant heater fuel pump will not start pumping fuel again until the coolant temperature reaches 75°C (167°F).

FUNCTIONAL PRINCIPLES:

- The vehicle coolant pump continuously circulates the coolant over the heat exchanger inside the fuel operated heater and throughout the coolant system.
- The coolant heater fuel pump pumps the fuel from the vehicle fuel tank to the combustion chamber.
- Coolant heater blower blows the oxygen, which is necessary for the combustion process, into the combustion chamber.
- A Coolant heater glow plug generates the evaporation energy and creates the temperature which is necessary to ignite the Air-Fuel mixture
- The heat exchanger inside the fuel operated heater transfers the energy of the combustion process into the engine coolant.
- Depending on the coolant temperature, which is detected by the coolant sensors, the heater chooses either high or low setting or gets shut off.

SELF TEST OF THE UNIT:

Before every start of the heater, the operation of the individual components is tested.

- Fuel operated heater control unit check
- Flame sensor
- Coolant sensor
- Overheating sensor
- Glow plug
- Fuel pump
- Blower motor

The fuel operated heater will only start after the self test of the heating unit is successful. Should a fault be detected, a fault notification will be output through the vehicle diagnosis.

DESCRIPTION OF SAFETY MECHANISM :

During start up the ECU is performing a random access memory (RAM), read-only memory (ROM) and electrically erasable programmable read-only memory (EEPROM) test. If failures occur during a self test of the unit, the unit will not start.

- If the power supply voltage exceeds 16 volts the unit will not start or shut off with after purge time of 120 seconds.
- If the power supply voltage goes below 10.2 V for more than 40 seconds the unit will shut off and try to restart after a purge time of 120 seconds. If the failure occurs 3 times, then unit is not going to restart till next key off.

Description of component checks:

- Coolant Heater Blower Motor—After the unit is commanded on and before normal operation the blower is tested for an open circuit. While the heater is activated the blower is tested for a short to ground.
- Flame sensor—The flame sensor is tested continuously during operation for a short to ground, short to voltage or open circuit.
- Glow plug—After the unit is commanded and before normal operation the glow plug is tested for an open circuit. While the heater is activated the glow plug is tested for a short to ground.
- Coolant Heater Fuel Pump—After the coolant heater is commanded on and before normal operation is activated, the fuel pump is tested for an open circuit. While the coolant heater is activated the fuel pump is tested for a short to ground.
- Overheating Sensor and Coolant sensor—The overheat sensor and coolant sensor are tested continuously during operation for a short to ground, short to voltage or open circuit.

FIRST START OF THE UNIT (125 seconds):

After the self test was successfully completed a first start procedure sequence is attempted.

1. The ceramic glow plug starts to heat the combustion chamber.
2. After a delay, the blower switches on. During the start procedure, the blower continuously increases blowing speed.
3. The fuel pump pumps fuel into the combustion chamber. The cycle frequency of the fuel pump is also continuously increased during the start procedure.
4. The glow plug starts to vaporize the fuel, and creates the temperature to ignite the fuel.
5. After ignition, the heater runs continuously to reach the maximum heating power.
6. After the flame sensor has detected the flame, the start procedure is complete, and the glow plug switches off.

SECOND START OF THE UNIT (125 seconds):

If the first start is not successful, the heater attempts a second restart process. In doing this, the glow plug voltage is increased, in order to obtain better starting conditions. The first start sequence is then repeated.

UNSUCCESSFUL SECOND START:

If the second start is not successful in igniting the heater, a fault code is output from the heater.

- A new attempt to start will only occur after the ignition switch is cycled.
- After 10 failed ignition cycles one after the other, all further start attempts are stopped by the control unit. This inhibit state can only be released by clearing the codes with a scan tool.

A/C Cycle

Refrigerant is the key element in an air conditioning system. R-134a is presently the only EPA approved refrigerant for automotive use. R-134a is an very low temperature gas that can transfer the undesirable heat and moisture from the passenger compartment to the outside air.

The A/C compressor is belt driven and operates when the magnetic clutch is engaged. The compressor builds pressure on the vapor refrigerant. Compressing the refrigerant also adds heat to the refrigerant. The refrigerant is discharged from the compressor, through the discharge hose, and forced to flow to the condenser and then through the balance of the A/C system. The A/C system is mechanically protected with the use of a high pressure relief valve. If the high pressure switch were to fail or if the refrigerant system becomes restricted and refrigerant pressure continued to rise, the high pressure relief will pop open and release refrigerant from the system.

Compressed refrigerant enters the condenser in a high temperature, high pressure vapor state. As the refrigerant flows through the condenser, the heat of the refrigerant is transferred to the ambient air passing through the condenser. Cooling the refrigerant causes the refrigerant to condense and change from a vapor to a liquid state.

The condenser is located in front of the radiator for maximum heat transfer. The condenser is made of aluminum tubing and aluminum cooling fins, which allows rapid heat transfer for the refrigerant. The semi-cooled liquid refrigerant exits the condenser and flows through the liquid line, to the orifice tube.

The orifice tube is located in the liquid line between the condenser and the evaporator. The orifice tube is the dividing point for the high and the low pressure sides of the A/C system. As the refrigerant passes through the orifice tube, the pressure on the refrigerant is lowered. Due to the pressure differential on the liquid refrigerant, the refrigerant will begin to vaporize at the orifice tube. The orifice tube also meters the amount of liquid refrigerant that can flow into the evaporator.

Refrigerant exiting the orifice tube flows into the evaporator core in a low pressure, liquid state. Ambient air is drawn through the HVAC module and passes through the evaporator core. Warm and moist air will cause the liquid refrigerant boil inside of the evaporator core. The boiling refrigerant absorbs heat from the ambient air and draws moisture onto the evaporator. The refrigerant exits the evaporator through the suction line and back to the compressor, in a vapor state, and completing the A/C cycle of heat removal. At the compressor, the refrigerant is compressed again and the cycle of heat removal is repeated.

The conditioned air is distributed through the HVAC module for passenger comfort. The heat and moisture removed from the passenger compartment will also change form, or condense, and is discharged from the HVAC module as water.

A/C Cycle with Auxiliary

The auxiliary A/C system operates from the vehicles primary A/C system. The front or primary A/C system must be ON to allow the rear A/C system to function.

Refrigerant is the key element in an air conditioning system. R-134a is presently the only EPA approved refrigerant for automotive use. R-134a is an very low temperature gas that can transfer the undesirable heat and moisture from the passenger compartment to the outside air.

The A/C system used on this vehicle is a non cycling system. Non cycling A/C systems use a high pressure switch to protect the A/C system from excessive pressure. The high pressure switch will OPEN the electrical signal, to the compressor clutch, in the event that the refrigerant pressure becomes excessive. After the high and low side of the A/C system pressure equalize, the high pressure switch will CLOSE. Closing the high pressure switch will complete the electrical circuit to the compressor clutch. The A/C system is also mechanically protected with the use of a high pressure relief valve. If the high pressure switch were to fail or if the refrigerant system becomes restricted and refrigerant pressure continued to rise, the high pressure relief will pop open and release refrigerant from the system.

The A/C compressor is belt driven and operates when the magnetic clutch is engaged. The compressor builds pressure on the vapor refrigerant. Compressing the refrigerant also adds heat to the refrigerant. The refrigerant is discharged from the compressor, through the discharge hose, and forced to flow to the condenser and then through the balance of the A/C system.

Compressed refrigerant enters the condenser in a high temperature, high pressure vapor state. As the refrigerant flows through the condenser, the heat of the refrigerant is transferred to the ambient air passing through the condenser. Cooling the refrigerant causes the refrigerant to condense and change from a vapor to a liquid state.

The condenser is located in front of the radiator for maximum heat transfer. The condenser is made of aluminum tubing and aluminum cooling fins, which allows rapid heat transfer for the refrigerant. The semi-cooled liquid refrigerant exits the condenser and flows through the liquid line. The liquid line flow is split and the liquid refrigerant flows to both the front or primary A/C system, and to the liquid line for the rear A/C system.

The liquid refrigerant, flowing to the rear A/C system, flows into the rear TXV. The rear TXV is located at the rear evaporator inlet. The TXV is the dividing point for the high and the low pressure sides of the rear A/C system. As the refrigerant passes through the TXV, the pressure on the refrigerant is lowered. Due to the

pressure differential on the liquid refrigerant, the refrigerant will begin to boil at the expansion device. The TXV also meters the amount of liquid refrigerant that can flow into the evaporator.

Refrigerant exiting the TXV flows into the evaporator core in a low pressure, liquid state. Ambient air is drawn through the rear A/C module and passes through the evaporator core. Warm and moist air will cause the liquid refrigerant boil inside of the evaporator core. The boiling refrigerant absorbs heat from the ambient air and draws moisture onto the evaporator. The refrigerant exits the evaporator through the suction line and back to the primary A/C systems suction line. Refrigerant in the primary A/C system suction line flows back to the compressor, in a vapor state, and completes the A/C cycle of heat removal. At the compressor, the refrigerant is compressed again and the cycle of heat removal is repeated.

The conditioned air is distributed through the rear A/C module for passenger comfort. The heat and moisture removed from the rear passenger compartment will also change form, or condense, and is discharged from the rear A/C module as water.

Section 6

Power and Signal Distribution

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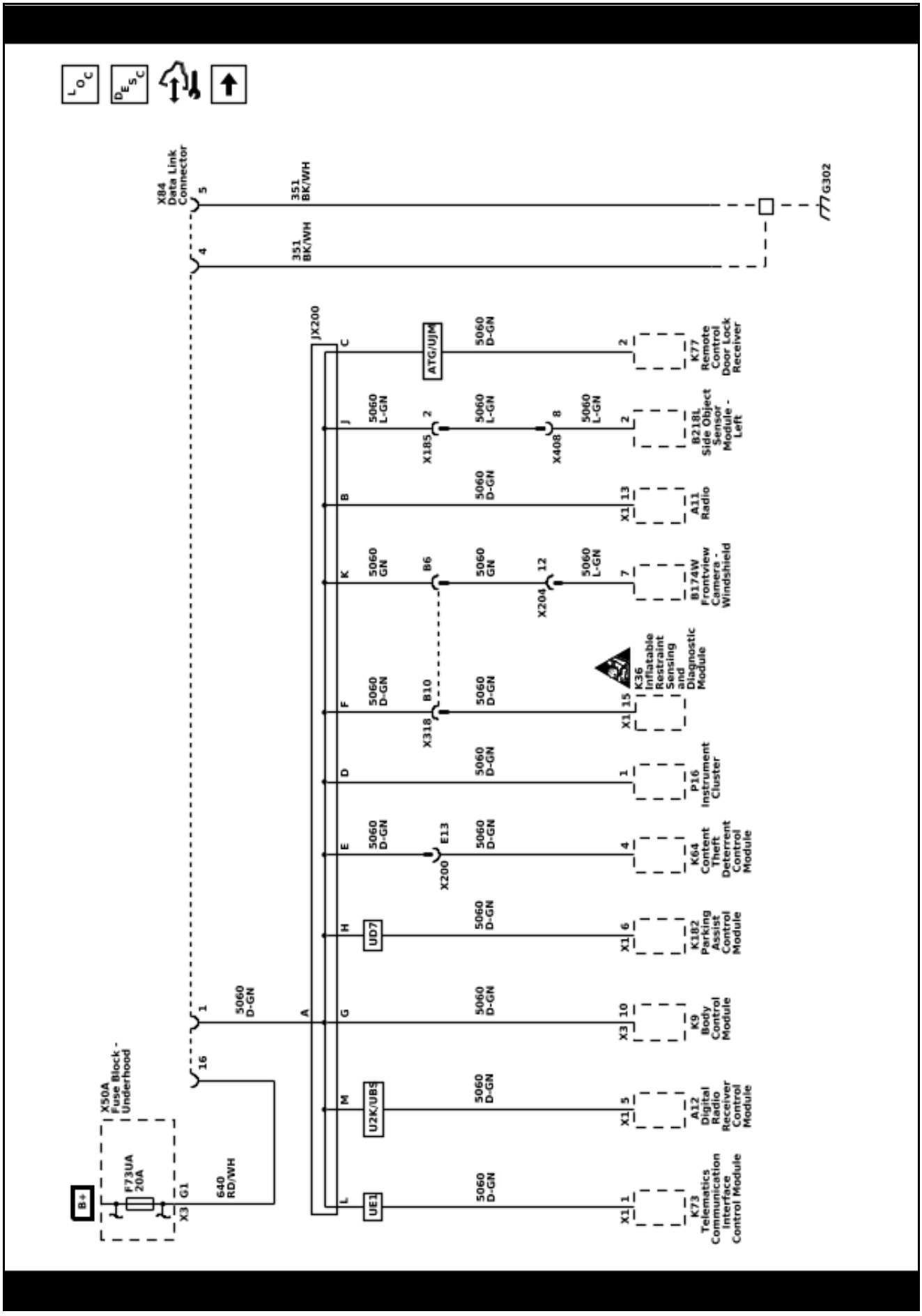
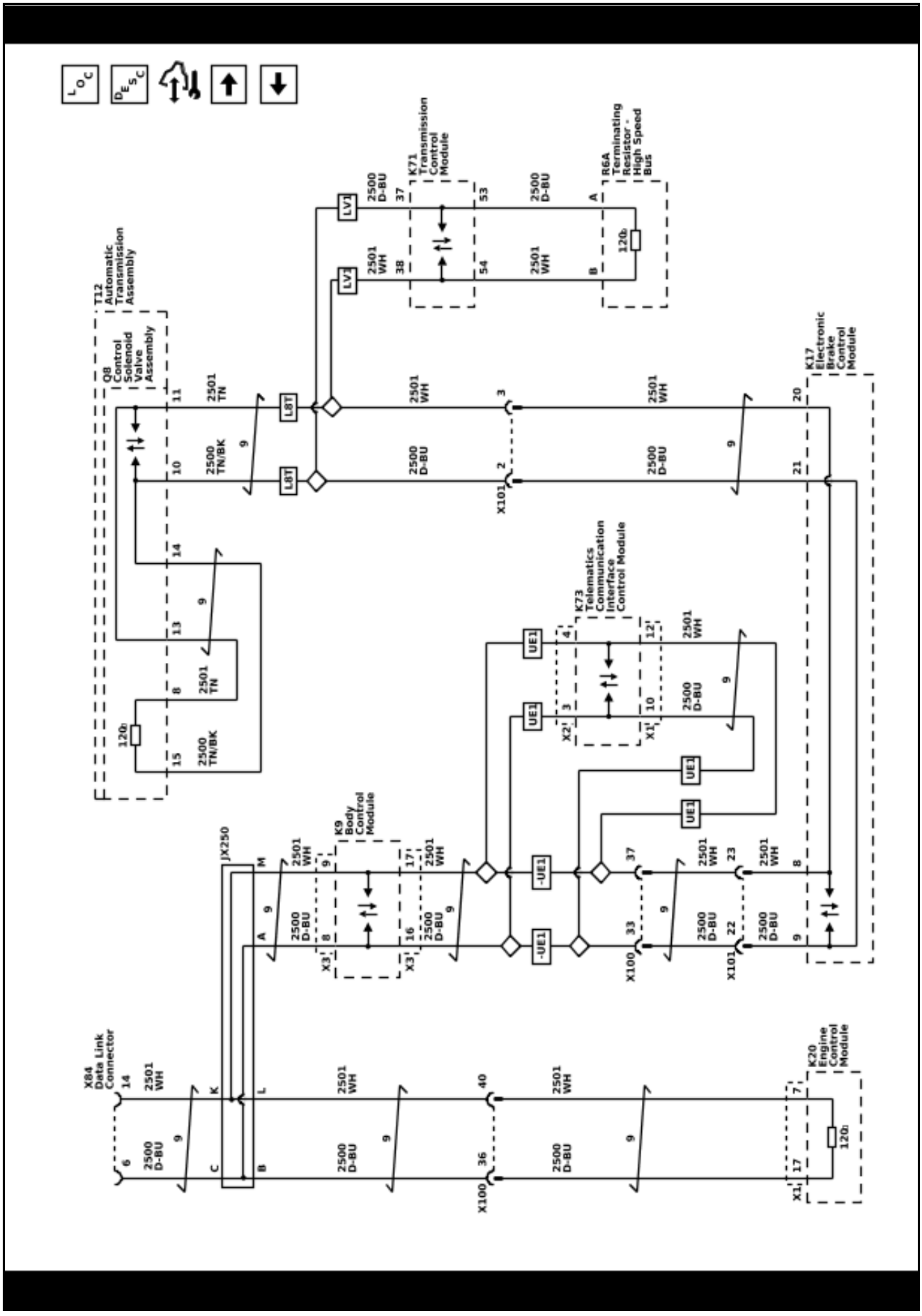
Data Communications

Schematic and Routing Diagrams

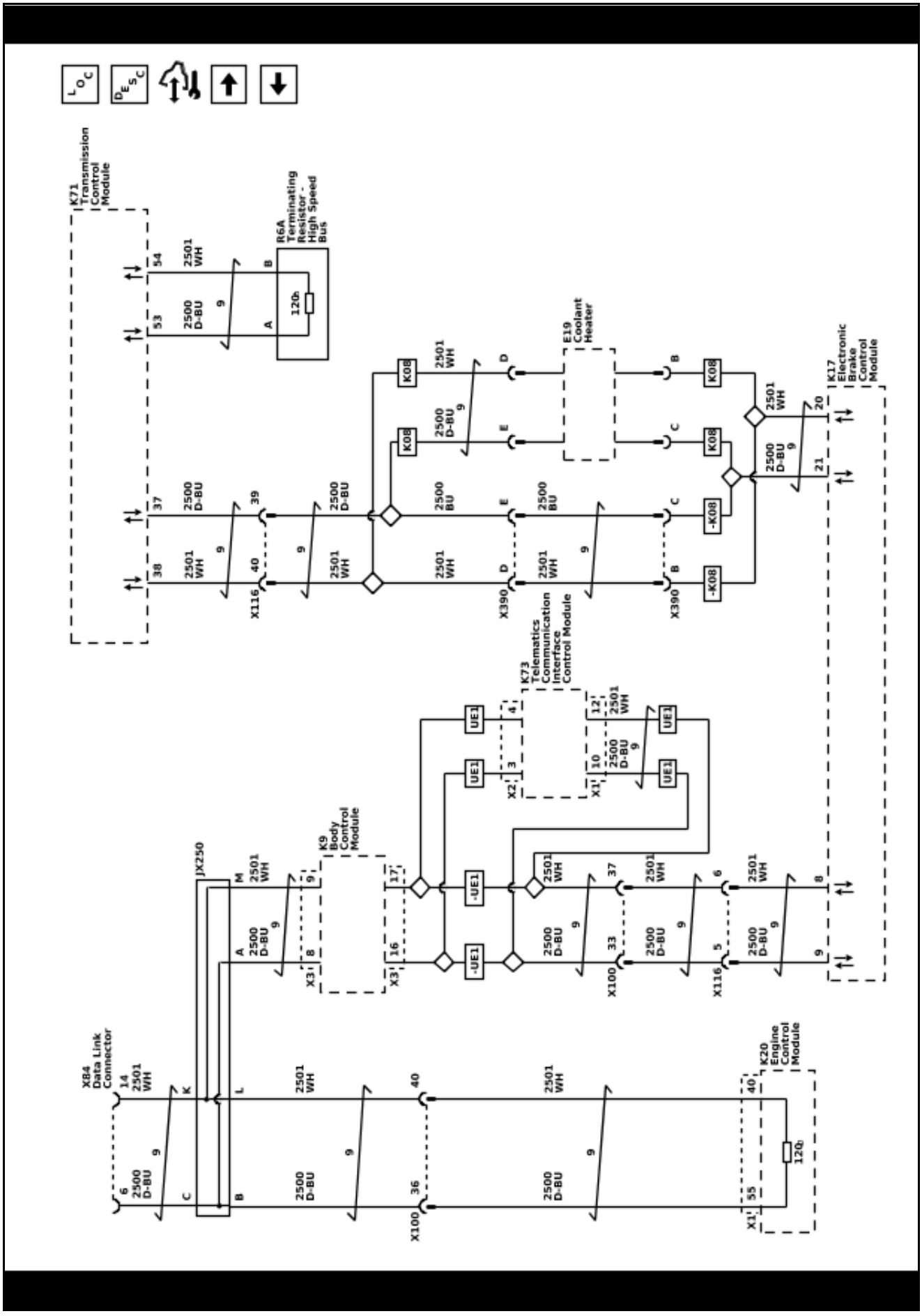
Data Communication Schematics (Low Speed GMLAN)



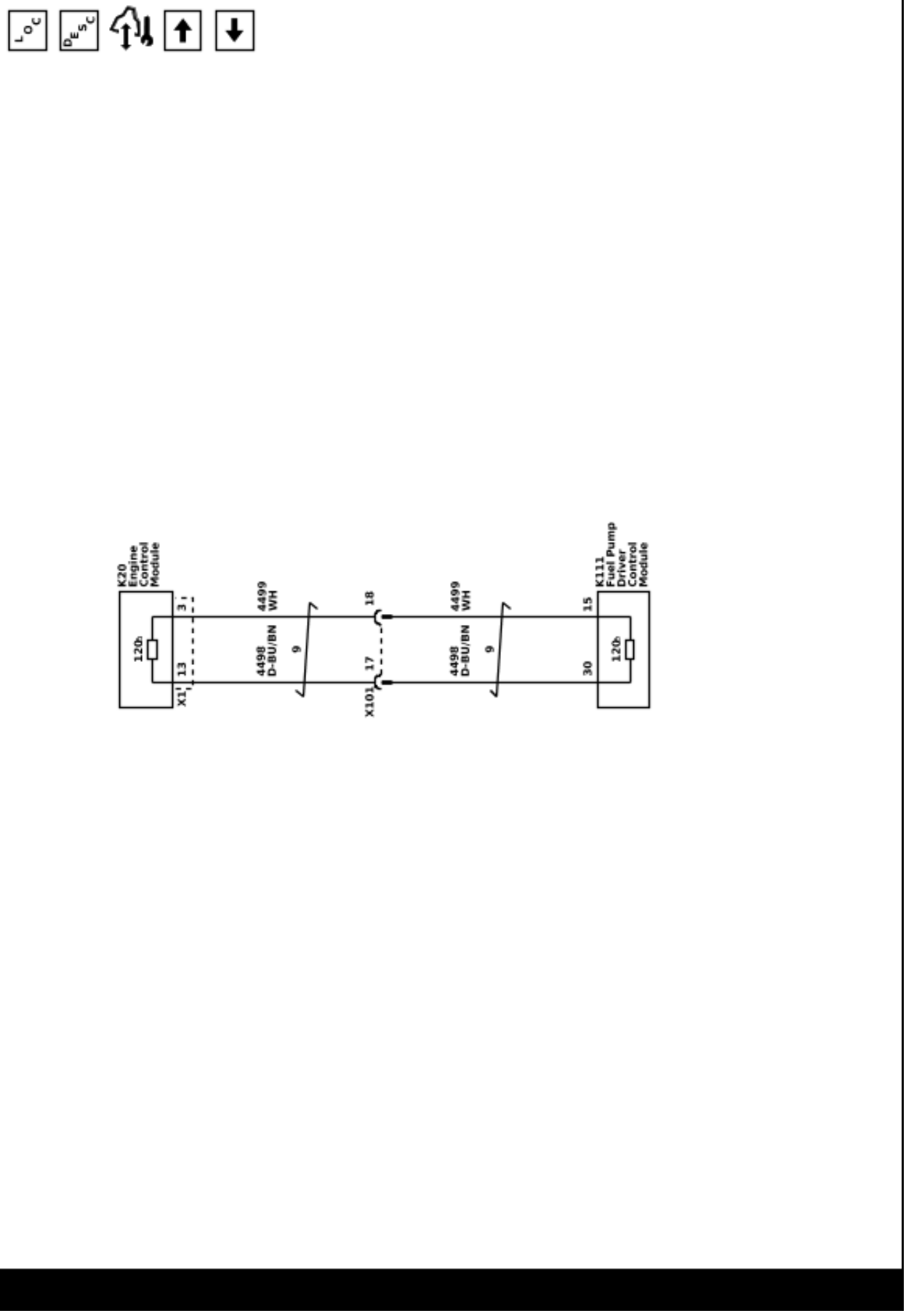
Data Communication Schematics (High Speed GMLAN (Gas))



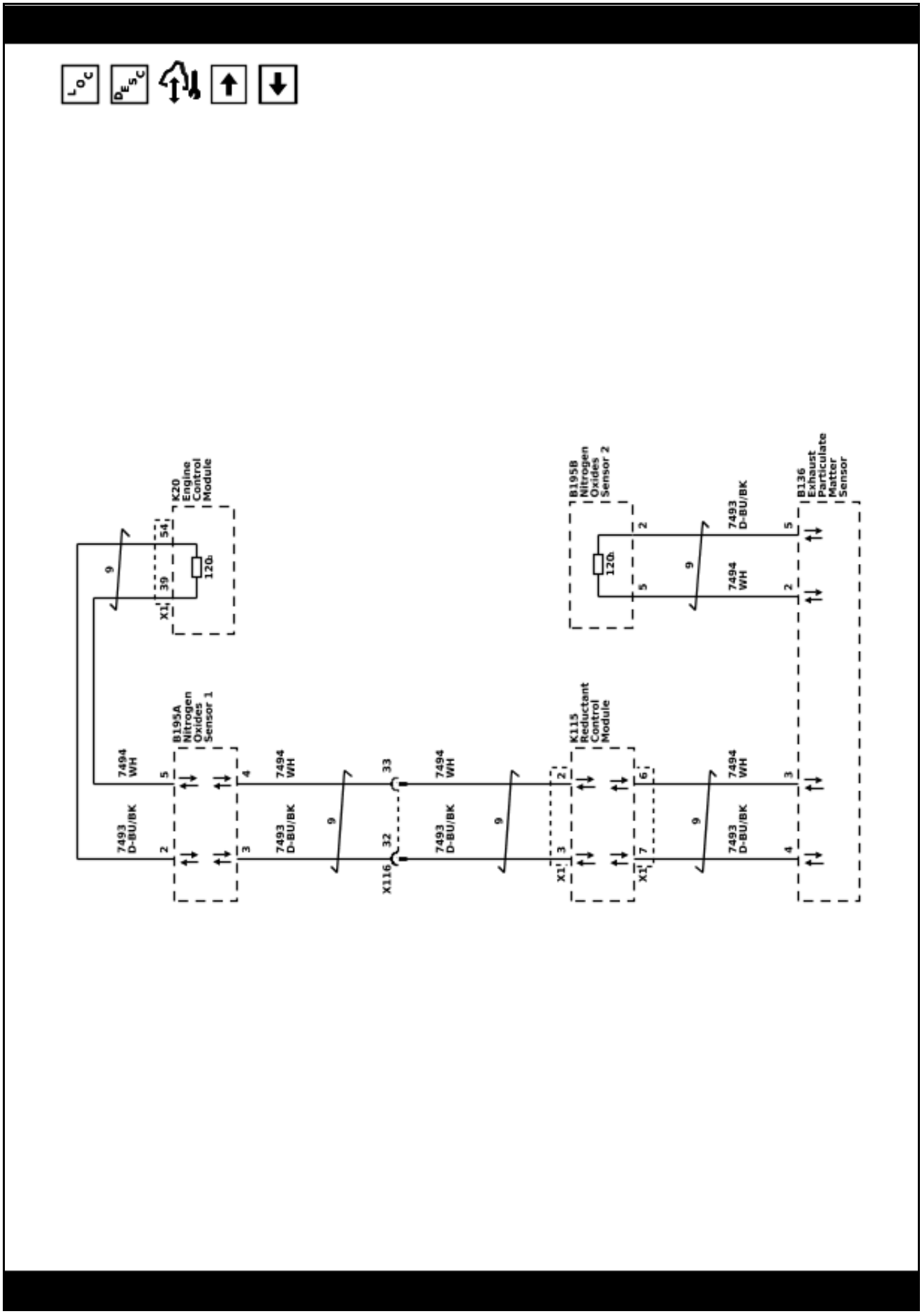
Data Communication Schematics (High Speed GMLAN (Diesel))



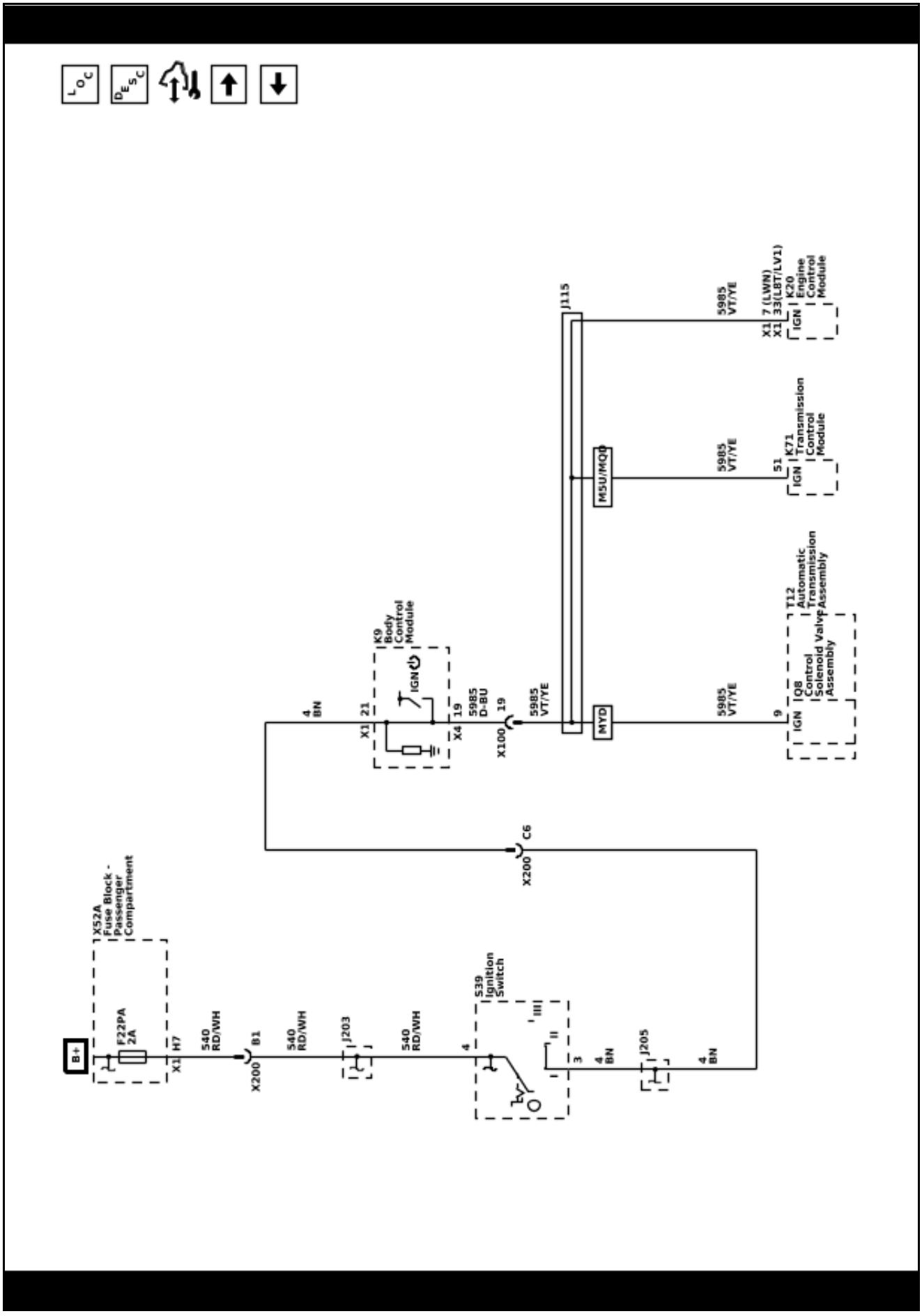
Data Communication Schematics (Powertrain High Speed GMLAN (LV1/L8T))



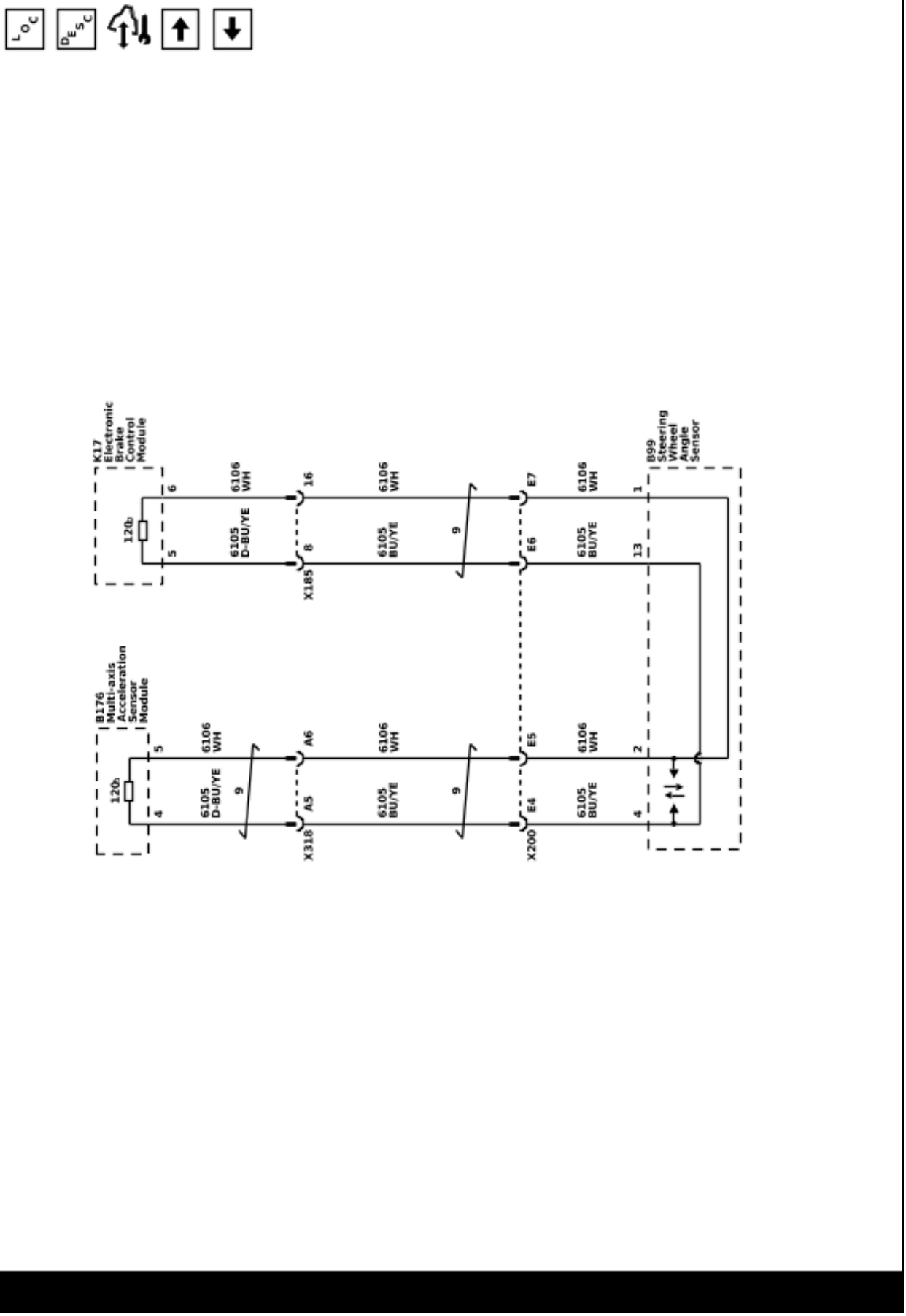
Data Communication Schematics (Powertrain High Speed GMLAN (LWN))



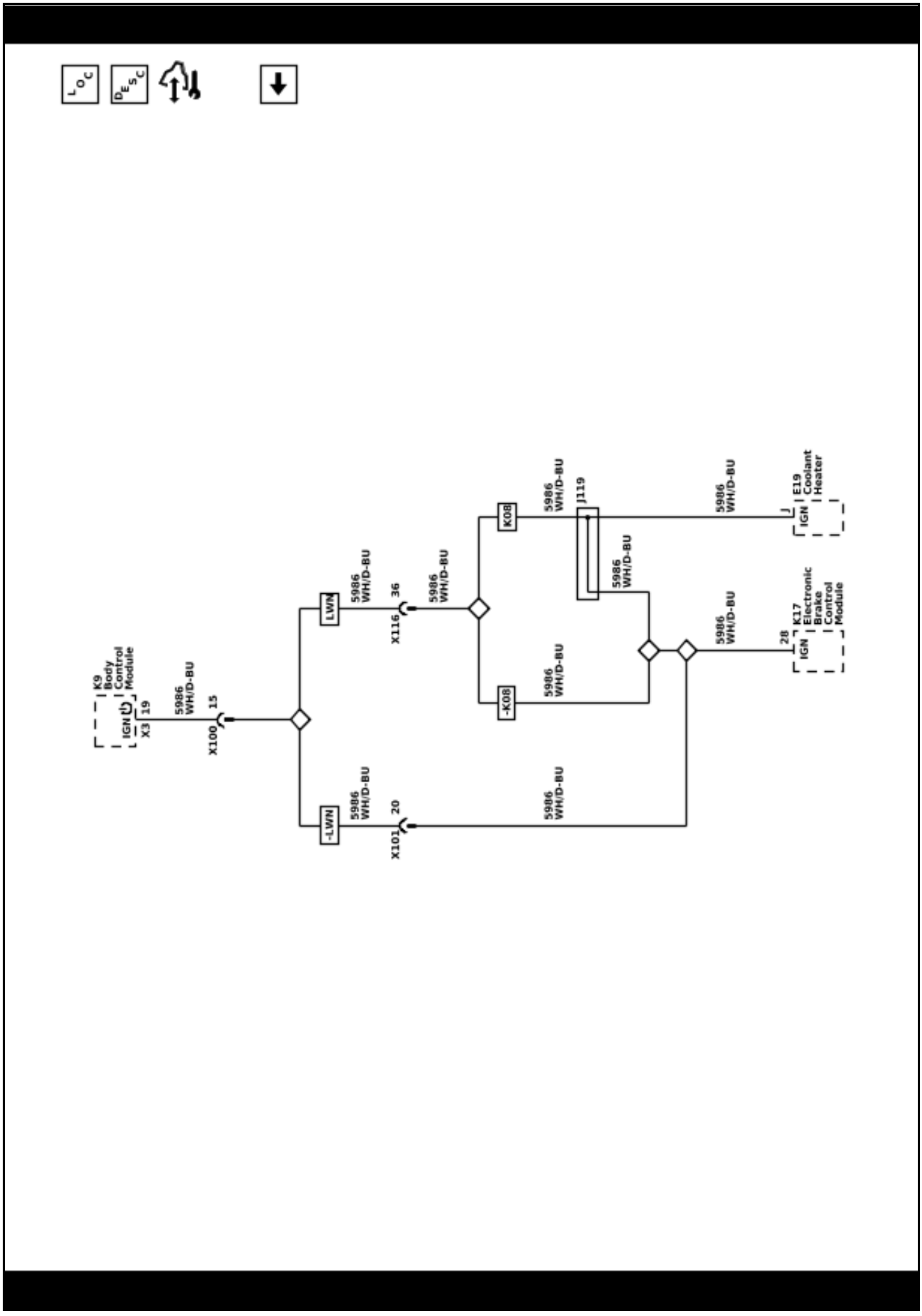
Data Communication Schematics (Accessory Wakeup)



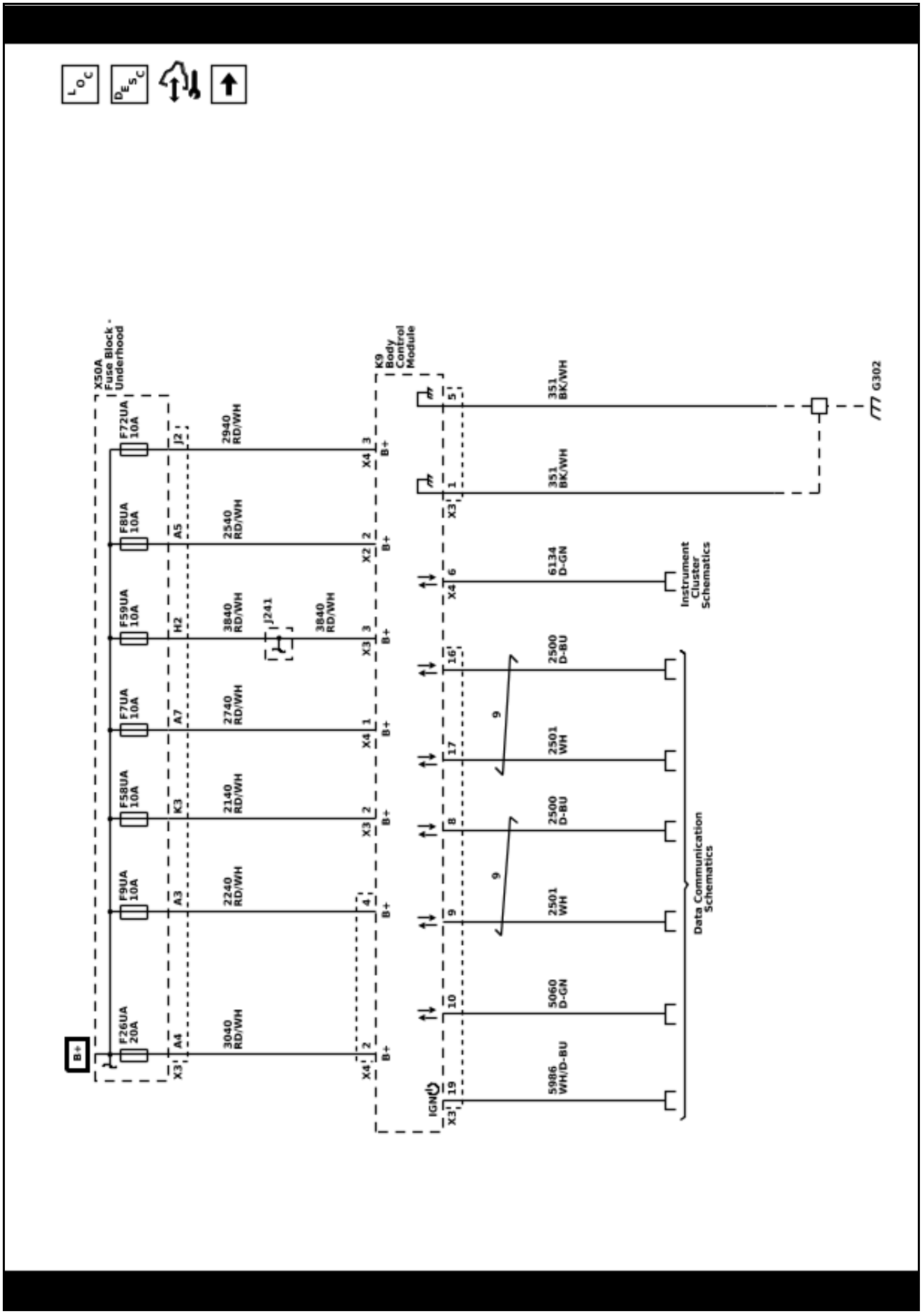
Data Communication Schematics (Chassis High Speed GMLAN)



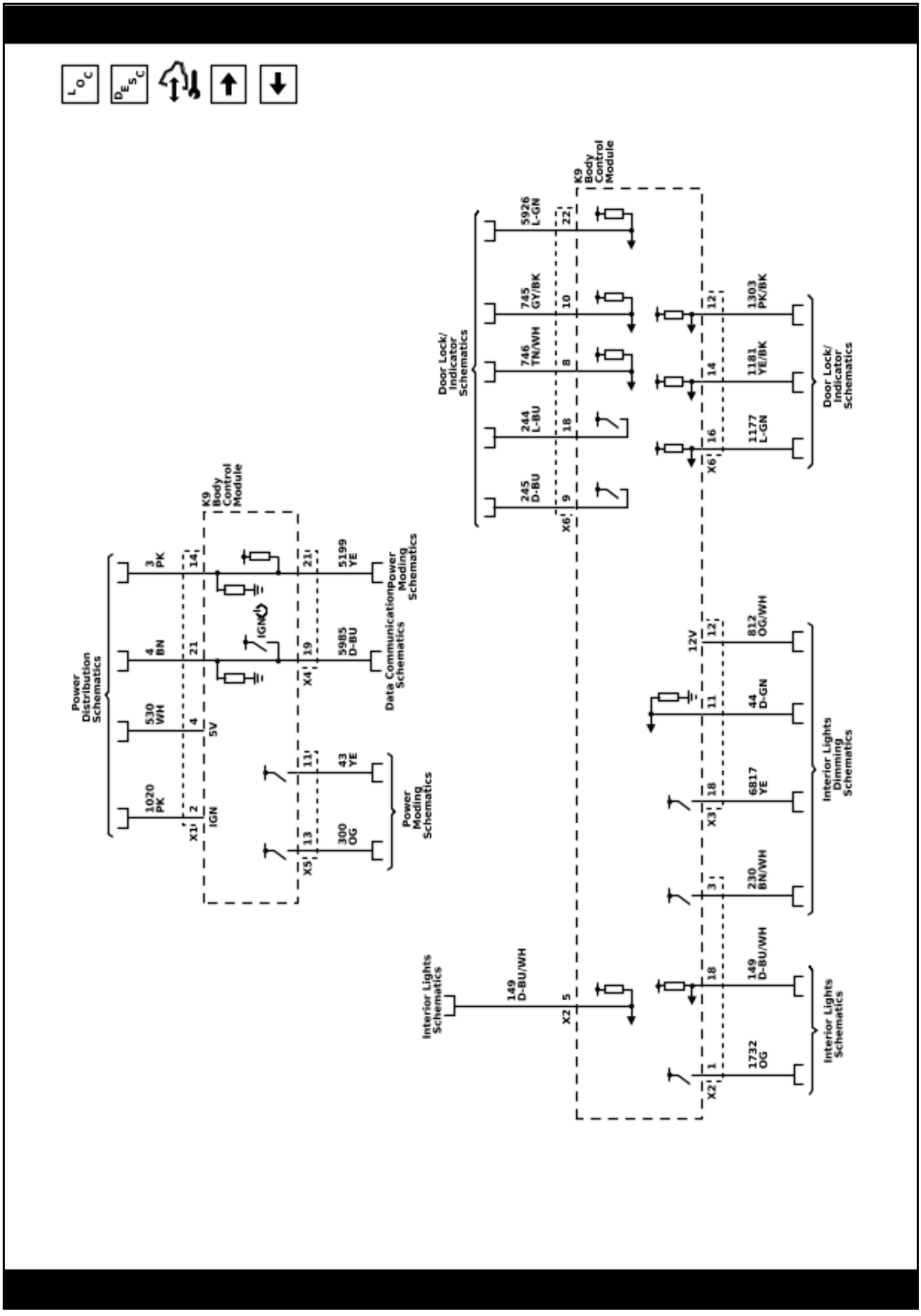
Data Communication Schematics (Communications Enable)



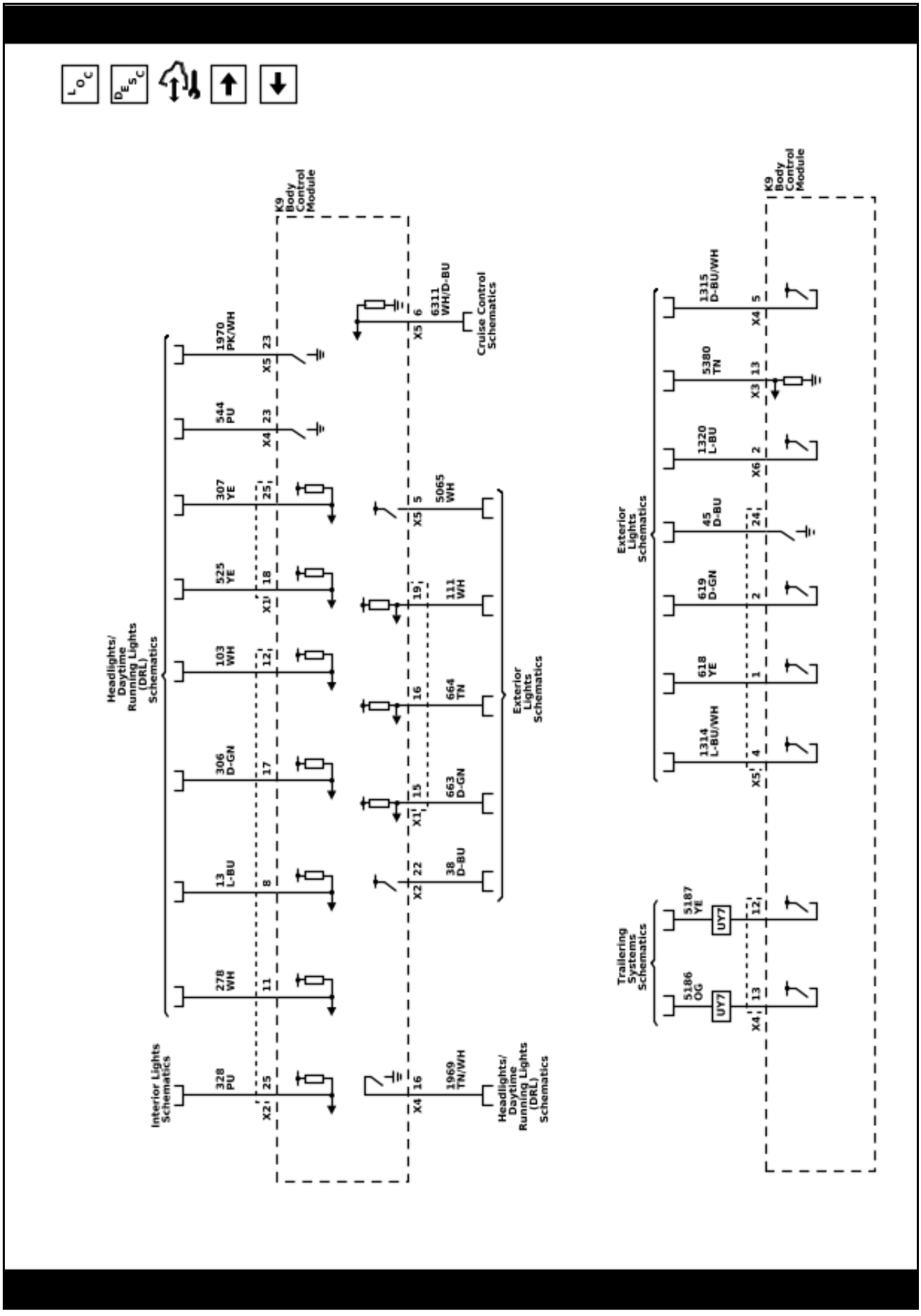
Body Control System Schematics (BCM Power, Ground and Serial Data)



Body Control System Schematics (BCM Inputs and Outputs (1 of 3))



Body Control System Schematics (BCM Inputs and Outputs (2 of 3))



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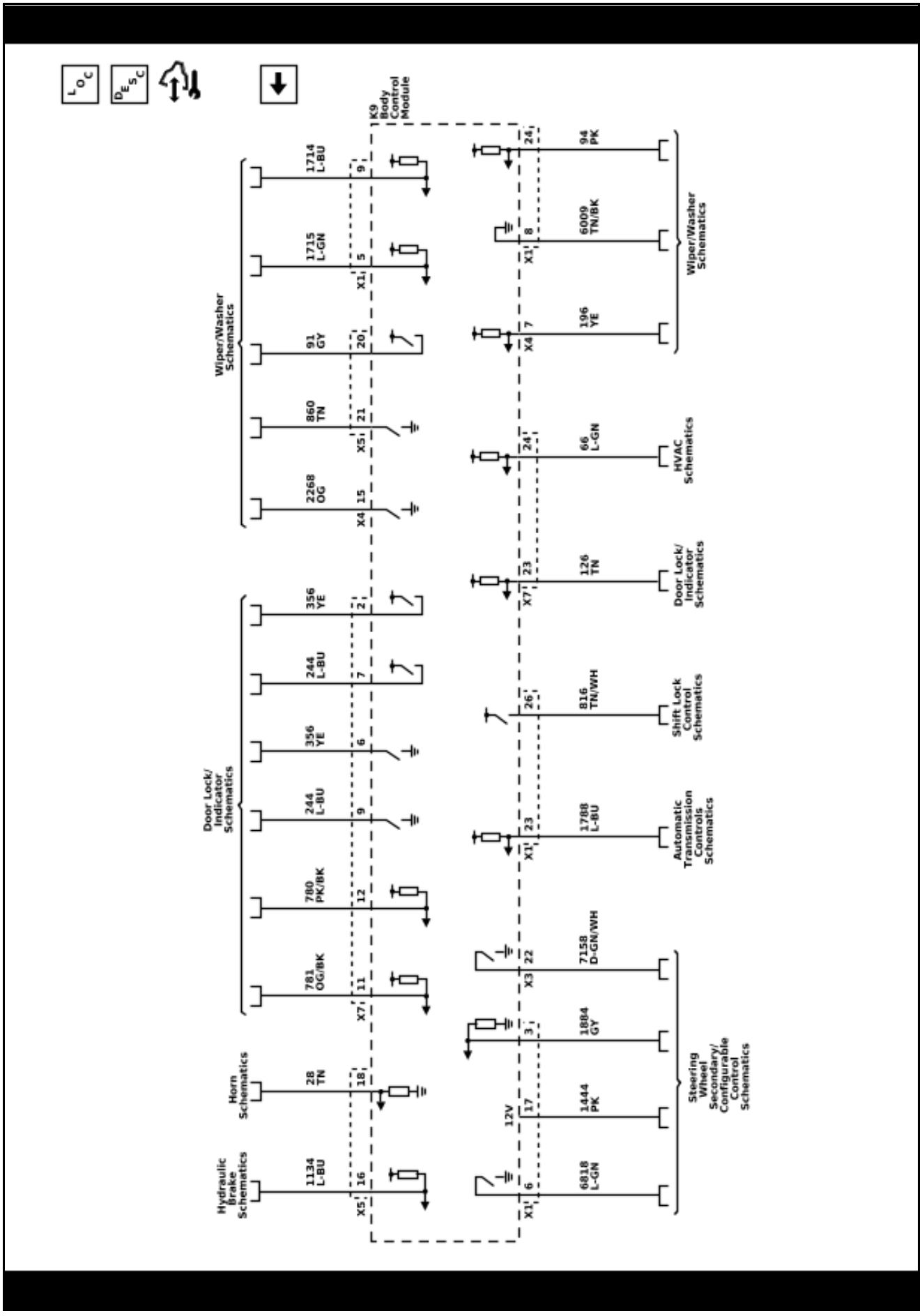
Body Control System Schematics (BCM Inputs and Outputs (3 of 3))



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Description and Operation

Body Control System Description and Operation

The body control system consists of the body control module (BCM), communications, and various input and outputs. Some inputs, outputs and messages require other modules to interact with the BCM. The BCM also has discrete input and output terminals to control the vehicle's body functions. The BCM is wired to the GMLAN High speed serial data bus and the GMLAN Low speed serial data bus and acts as a gateway between them. If the BCM does not communicate the vehicle will not start due to the inability of the Engine/ Powertrain Control Module (ECM/PCM) and Vehicle Theft Deterrent (VTD) Control Module to communicate without the BCM providing the gateway function.

Power Mode Master

This vehicles BCM functions as the power mode master (PMM). The ignition switch is a low current switch with multiple discrete ignition switch signals to the PMM for determination the power mode that will be sent over the serial data circuits to the other modules that need this information, and so the PMM will activate relays and other direct outputs of the PMM as needed. Refer to Power Mode Description and Operation for a complete description of power mode functions.

Serial Data Gateway

The BCM in this vehicle functions as a gateway or translator. The purpose of the gateway is to translate serial data messages between the GMLAN high speed bus and the GMLAN low speed bus for communication between the various modules. The gateway will interact with each network according to that network's transmission protocol.

One example of this necessary communication is the communication between the Engine/Powertrain Control Module (ECM/PCM) which is high speed serial data and Vehicle Theft Deterrent (VTD) Control Module which is low speed serial data. If these modules can not exchange information, the vehicle will not start.

Communication between the BCM and a scan tool can be on the high speed GMLAN network or low speed GMLAN network. If one network is lost, the BCM can still communicate with the scan tool. A lost communication DTC typically is set in modules other than the module with a communication failure.

Body Control Module

The various body control module (BCM) input and output circuits are described in the corresponding functional areas indicated on the BCM electrical schematics. Some BCM functions with the subsystems may be as a gateway only or as an enable for the system. The BCM related systems/subsystems include, but are not limited to the following:

- Antilock brake system (ABS)—Refer to ABS Description and Operation.
- Cruise control system—Refer to Cruise Control Description and Operation.
- Exterior lighting—Refer to *Exterior Lighting Systems Description and Operation on page 2-25*.
- Horn system —Refer to *Horns System Description and Operation on page 2-9*.
- Instrument cluster indicator control—Refer to Instrument Cluster Description and Operation.
- Interior lighting—Refer to *Interior Lighting Systems Description and Operation on page 2-26*.
- Power door lock system —Refer to *Power Door Locks Description and Operation on page 2-36*.
- Rear window defogger system —Refer to *Rear Window Defogger Description and Operation on page 2-6*.
- Remote function actuation (RFA) control—Refer to *Keyless Entry System Description and Operation on page 7-9*.
- Retained accessory power (RAP)— Refer to Retained Accessory Power Description and Operation.
- Shift lock control system —Refer to *Automatic Transmission Shift Lock Control Description and Operation on page 8-5*.
- Starting system—Refer to *Starting System Description and Operation on page 4-17*.
- Supplemental inflatable restraint (SIR) system — Refer to *Supplemental Inflatable Restraint System Description and Operation on page 7-16*.
- Theft deterrent—Refer to *Immobilizer Description and Operation on page 7-5*.
- Wiper/Washer system functions—Refer to Wiper/ Washer System Description and Operation.

Data Link Communications Description and Operation

Circuit Description

The communication among control modules is performed primarily through the GMLAN high speed serial data circuit and the GMLAN low speed serial data circuits. The modules that need real time communication are attached to the high speed GMLAN network. The body control module (BCM) is the serial data gateway between the networks. The purpose of the gateway is to translate serial data messages between the GMLAN high speed bus and the GMLAN low speed bus. The Local Interconnect Network (LIN) is another serial data communication network used on this vehicle which is dedicated to the remote compass module (RCM) subsystem. Below are more detailed descriptions of the individual networks. The gateway will interact with each network according to that network's transmission protocol. Refer to *Body Control System Description and Operation on page 6-16* for more information about the gateway.

GMLAN High Speed Circuit Description

The data link connector (DLC) allows a scan tool to communicate with the high speed GMLAN serial data circuit. The serial data is transmitted on two twisted wires that allow speed up to 500 Kb/s. The twisted pair is terminated with two 120 ohms resistors. The resistors are used to reduce noise on the High Speed GMLAN bus during normal vehicle operation. The high speed GMLAN is a differential bus. The high speed GMLAN serial data (+) and high speed GMLAN serial data (−)

are driven to opposite extremes from a rest or idle level. The idle level, which is approximately 2.5 volts, is considered recessive transmitted data and is interpreted as a logic 1. Driving the lines to their extremes, adds one volt to the high speed GMLAN serial data (+) and subtracts one volt from the high speed GMLAN serial data (−) wire. This dominant state is interpreted as a logic 0. GMLAN network management supports selective start up and is based on virtual networks. A virtual network is a collection of signals started in response to a vehicle event. The starting of a virtual network signifies that a particular aspect of the vehicles functionality has been requested. A virtual network is supported by virtual devices, which represents a collection of signals owned by a single physical device. So, any physical device can have one or more virtual devices. The signal supervision is the process of determining whether an expected signal is being received or not. Failsofting is the ability to substitute a signal with a default value or a default algorithm, in the absence of a valid signal. Some messages are also interpreted as a heartbeat of a virtual device. If such a signal is lost, the application will set a no communication code against the respective virtual device. This code is displayed on the Tech 2 screen as a code against the physical device. Note: a loss of serial data DTC does not represent a failure of the module that the code is set in.

GMLAN Low Speed Circuit Description

The data link connector (DLC) allows a scan tool to communicate with the low speed GMLAN serial data circuit. The serial data is transmitted over a single wire to the appropriate control modules. The transmission speed for GMLAN low speed is up to 83.33 Kb/s. Under normal vehicle operating conditions, the speed of the bus is 33.33 Kb/s. This protocol produces a simple pulse train sent out over the GMLAN low speed serial data bus. When a module pulls the bus high, 5 volts, this creates a dominant logic state or 0 on the bus. When the bus is pulled low, 0 volts, it is translated as a recessive logic state or 1. To wake the control modules connected to the GMLAN low speed serial data bus, a high voltage wake up pulse is sent out over the bus, the voltage level of the pules is +10 volts. Modules connected to the GMLAN low speed bus can be part of a virtual network as described in the previous paragraph. Most modules on the GMLAN low speed serial data bus are connected to the bus in a parallel configuration. Refer to the schematics to determine modules that are not in parallel

Local Interconnect Network (LIN) Description

The remote compass module (RCM) communicates with the BCM utilizing a single wire LIN communication link. The BCM is the gateway for the GMLAN network. All data is communicated on the LIN bus, therefore there are only 3 circuits to the RCM as follows:

- Ground
- LIN bus
- Voltage

Data Link Connector (DLC)

The data link connector (DLC) is a standardized 16-cavity connector. Connector design and location is dictated by an industry wide standard, and provides the following:

- Pin 1 GMLAN low speed communications terminal
- Pin 4 Scan tool power ground terminal
- Pin 5 Common signal ground terminal
- Pin 6 High speed GMLAN serial data bus (+) terminal
- Pin 14 High speed GMLAN serial data bus (−) terminal
- Pin 16 Scan tool power, battery positive voltage terminal

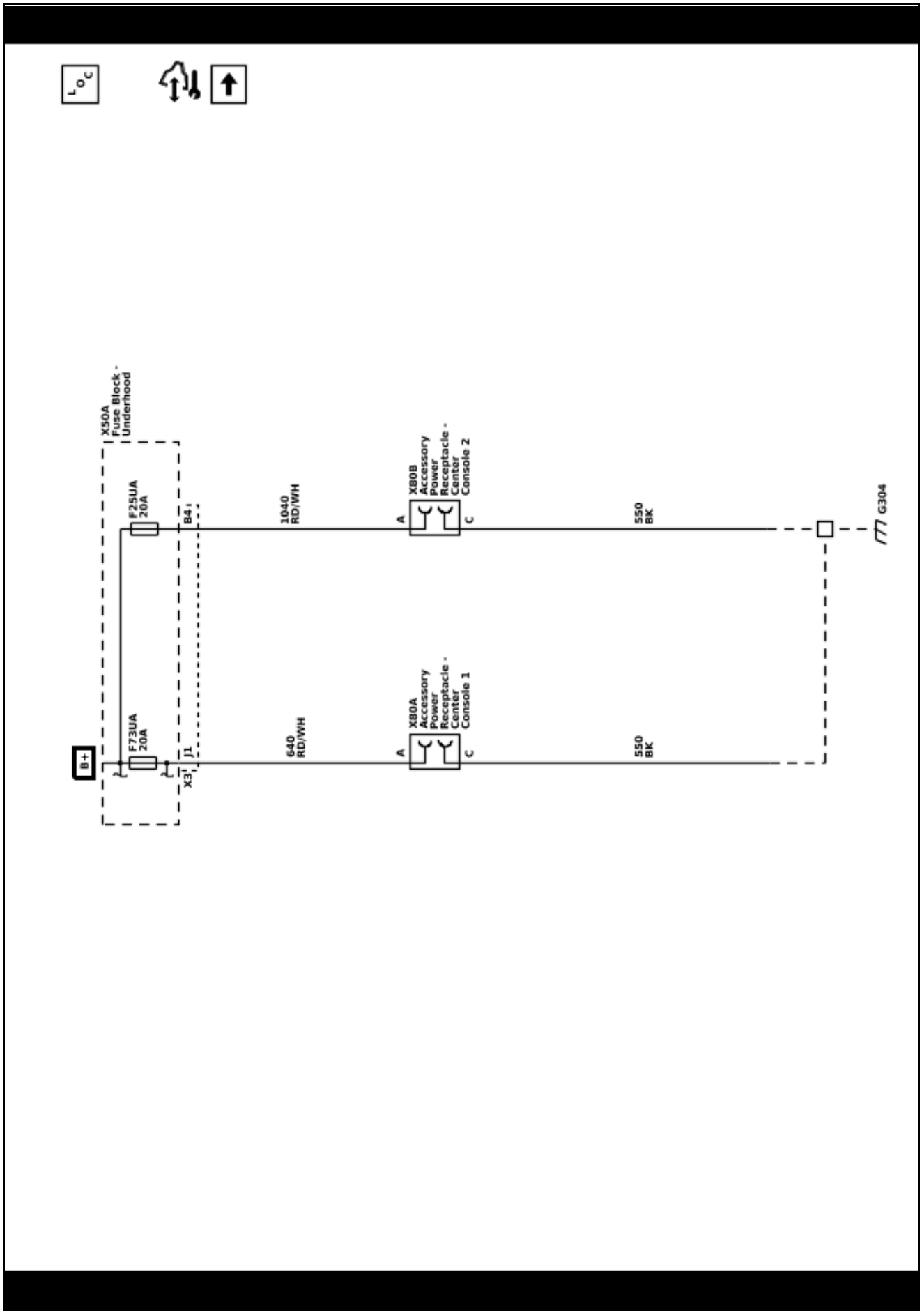
Serial Data Reference

The scan tool communicates over the various busses on the vehicle. When a scan tool is installed on a vehicle, the scan tool will try to communicate with every module that could be optioned into the vehicle. If an option is not installed on the vehicle, the scan tool will display No Comm for that options specific control module. In order to avert misdiagnoses of No Communication with a specific module, refer to Data Link References for a list of modules, the bus they communicate with, and the RPO codes for a specific module.

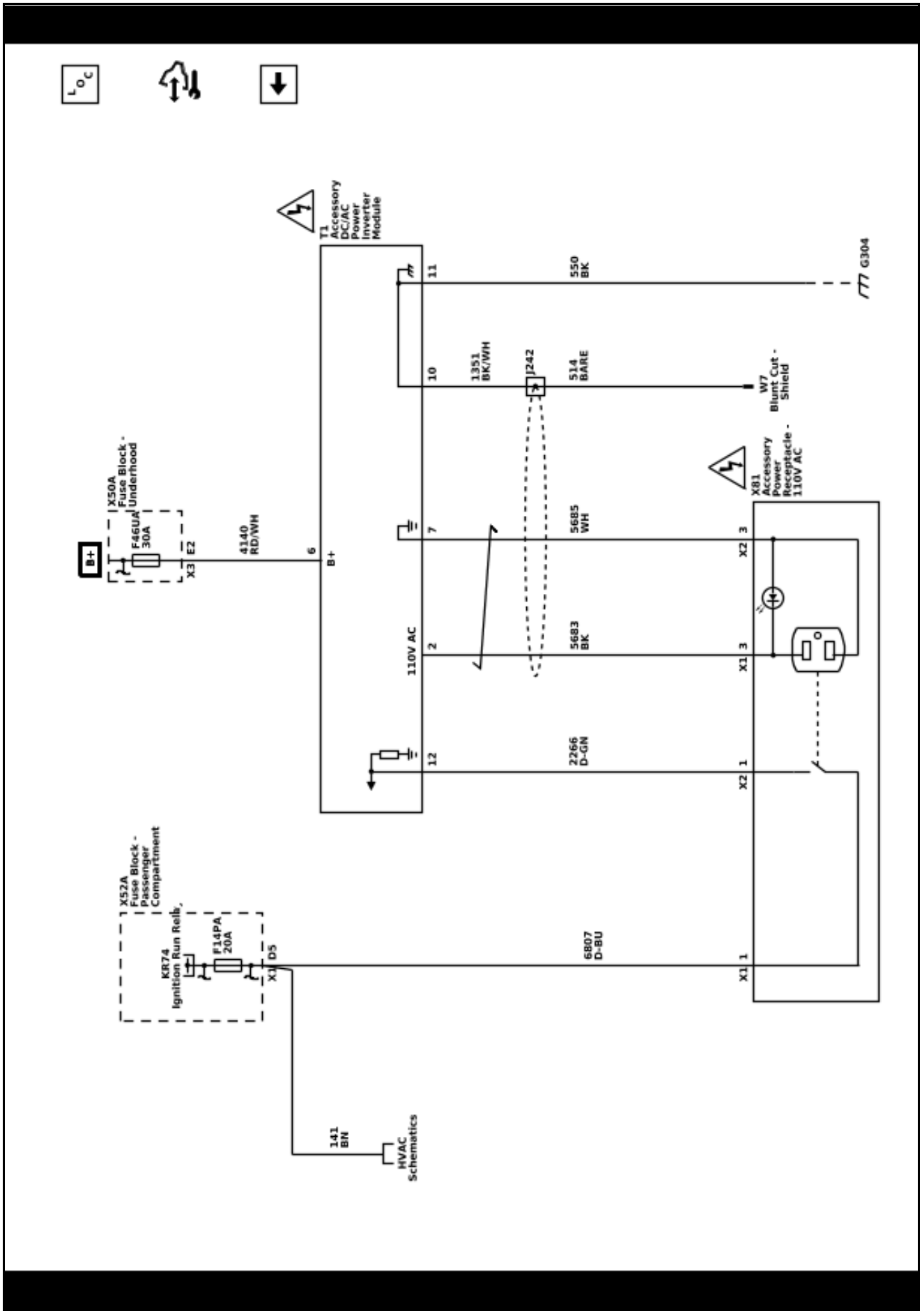
Power Outlets

Schematic and Routing Diagrams

Cigar Lighter/Power Outlet Schematics (Cigar Lighter/Power Outlet)



Cigar Lighter/Power Outlet Schematics (110V AC Outlet (KI4))



Description and Operation

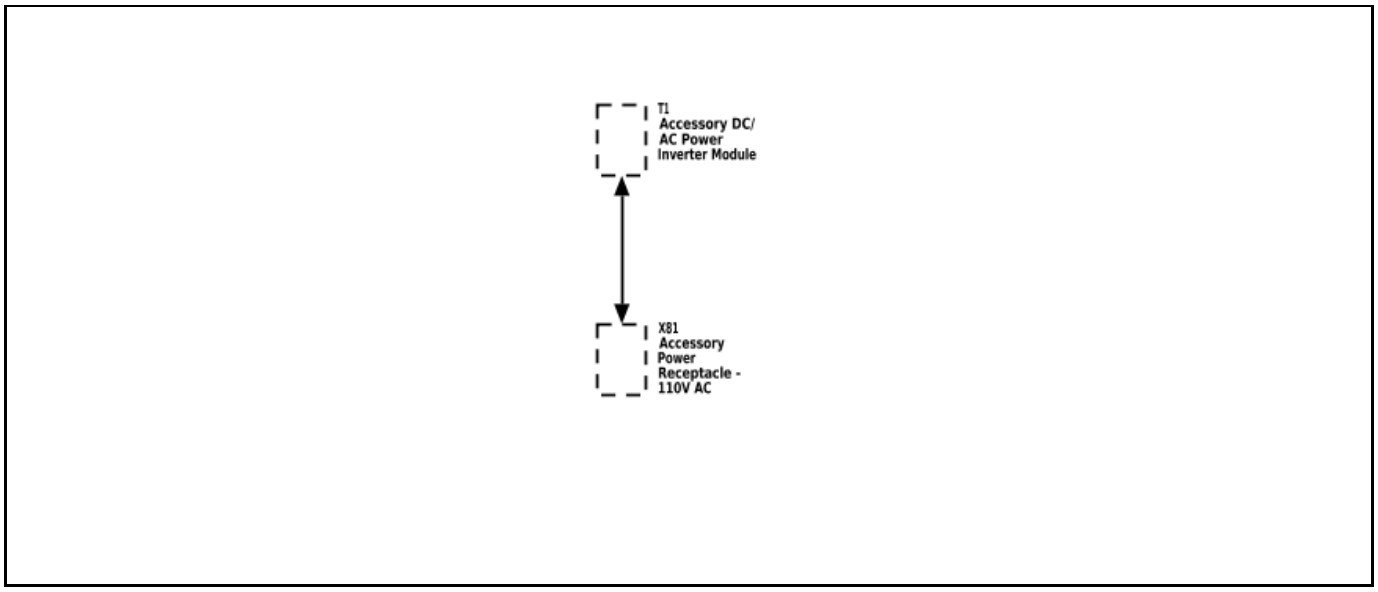
Power Outlets Description and Operation

12 Volt Power Outlet Receptacle Description and Operation

The 12 V accessory power receptacles are supplied B+ all the time.

110 Volt Power Outlet Receptacle System Description

Power Outlets Block Diagram



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The alternating current (AC) accessory power outlet system consists of the accessory DC/AC power inverter module and the accessory power receptacle – 110 V AC. The accessory DC/AC power inverter module converts 12 V direct current (DC) battery power to 110 V at 60 Hertz (Hz) AC power to operate AC powered devices. The accessory DC/AC power inverter module provides up to 150 watts of power. The accessory power receptacle – 110 V AC provides the usual connection for AC powered devices.

110 Volt Power Outlet Receptacle System Operation

The accessory DC/AC power inverter module receives fuse protected battery voltage and is connected to the 12 V electrical system ground. The accessory power receptacle – 110 V AC has an internal switch, that detects when an AC powered device is plugged into the outlet. When the ignition is ON, and an AC powered device is plugged into the accessory power receptacle – 110 V AC, the normally open switch in the accessory power receptacle – 110 V AC, closes. When the accessory DC/AC power inverter module detects the voltage from the accessory power receptacle – 110 V AC switch, the inverter module begins to supply 110 V AC to the accessory power receptacle – 110 V AC after a 1.5 second delay. The accessory AC power system is protected against circuit overload and circuit shorts to ground.

110 Volt Power Outlet Receptacle Isolation Fault Protection

The accessory DC/AC power inverter module contains a ground fault circuit interrupter (GFCI). GFCI monitors the 110 V circuit for a short to vehicle chassis ground. If a 110 V AC short to ground is detected, the accessory DC/AC power inverter module will turn OFF. The module remains OFF, until the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 second delay.

110 Volt Power Outlet Receptacle Overload Shutdown

The accessory DC/AC power inverter module will turn OFF if the current in the 110 V circuit is greater than 3.8 A for 1 second, or 2.5 A for 10 seconds. The module will turn ON again, when the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 second delay.

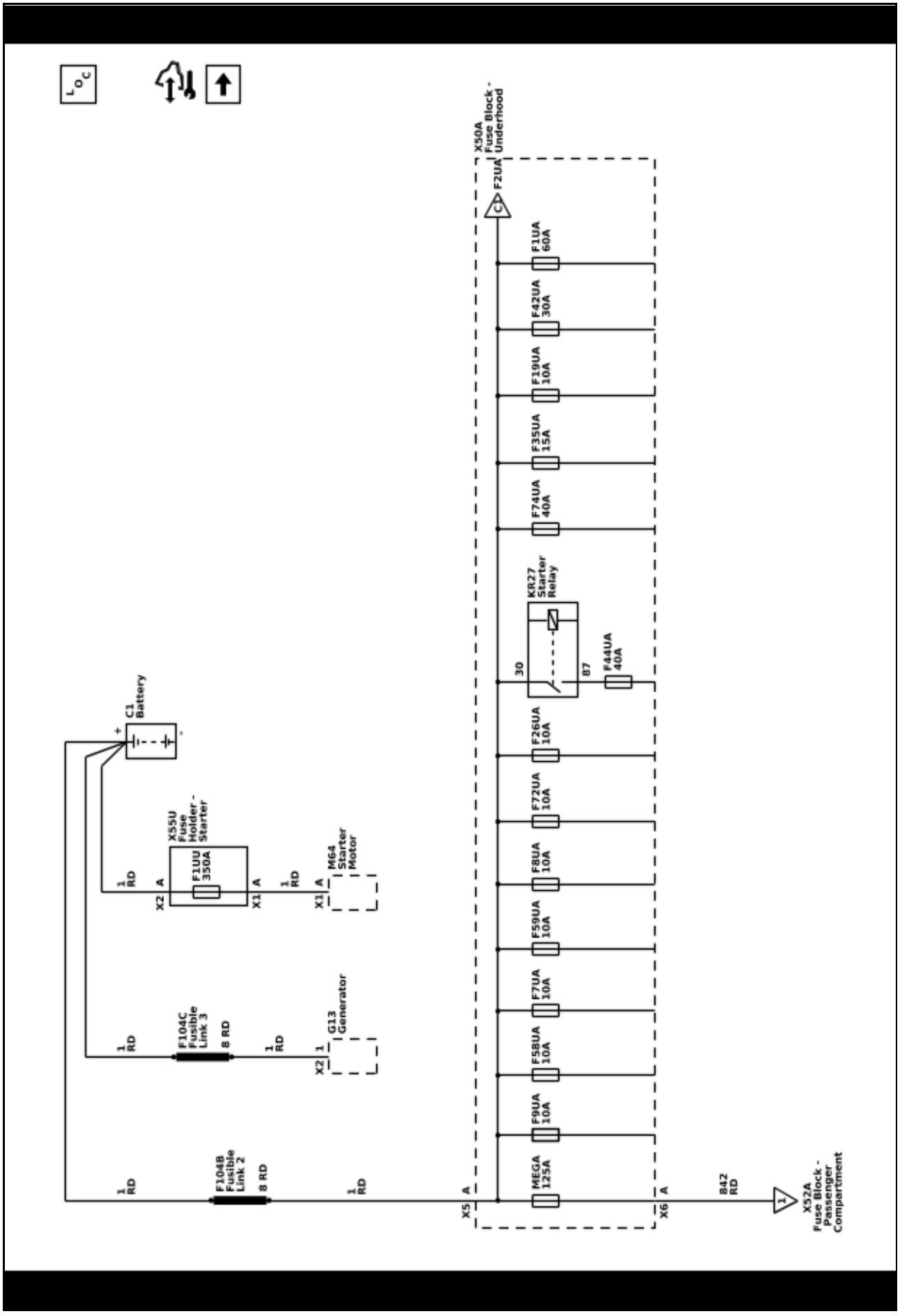
110 Volt Power Outlet Receptacle Internal Shutdown

The accessory DC/AC power inverter module will turn OFF if the B+ supply voltage is greater than 16.5 V or less than 11 V. The module will also turn OFF if the device temperature is greater than 85°C (185°F). The module will turn ON again, after the shutdown condition is corrected, and the AC powered device is unplugged from the outlet, and then plugged into the outlet.

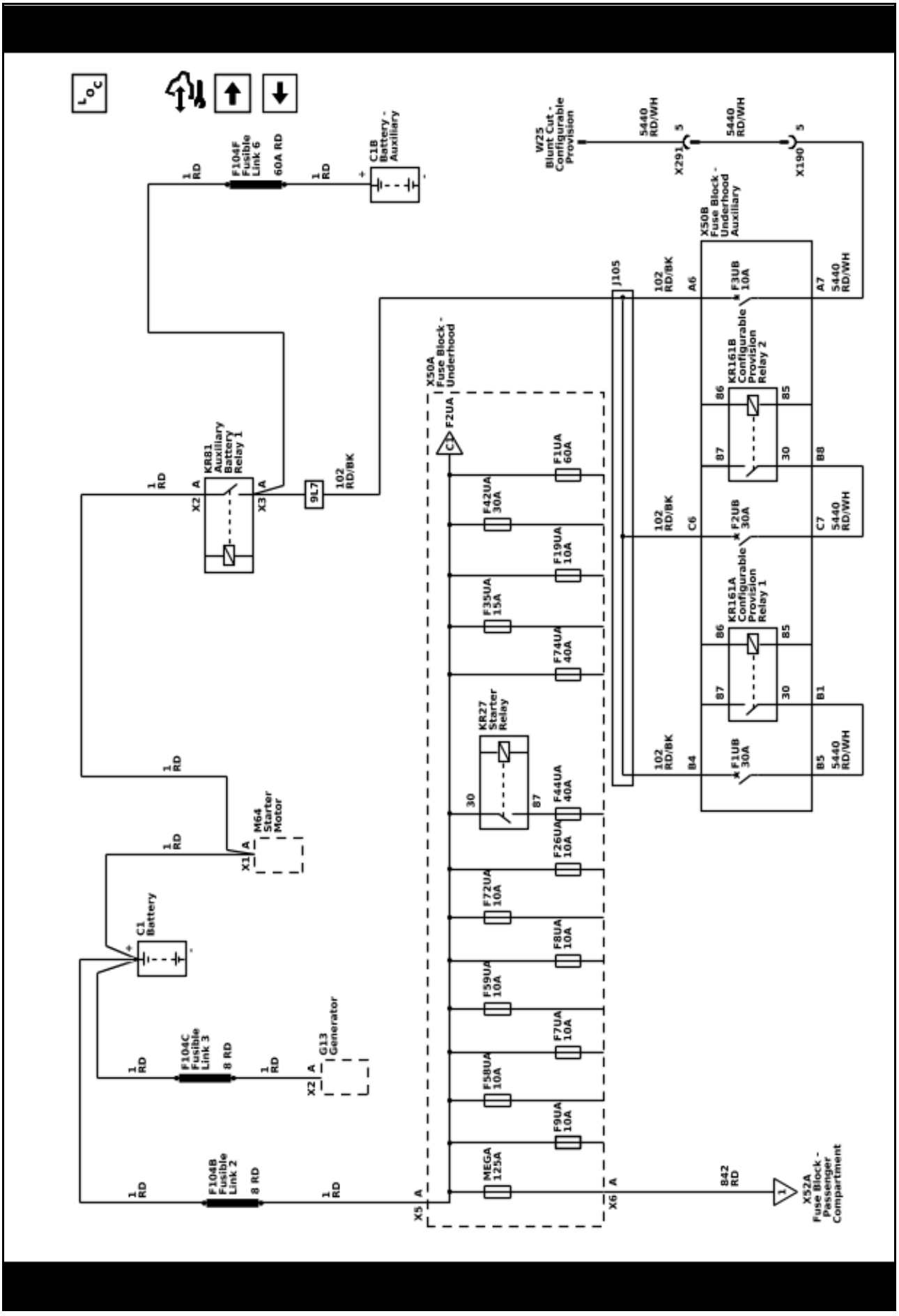
Wiring Systems and Power Management

Schematic and Routing Diagrams

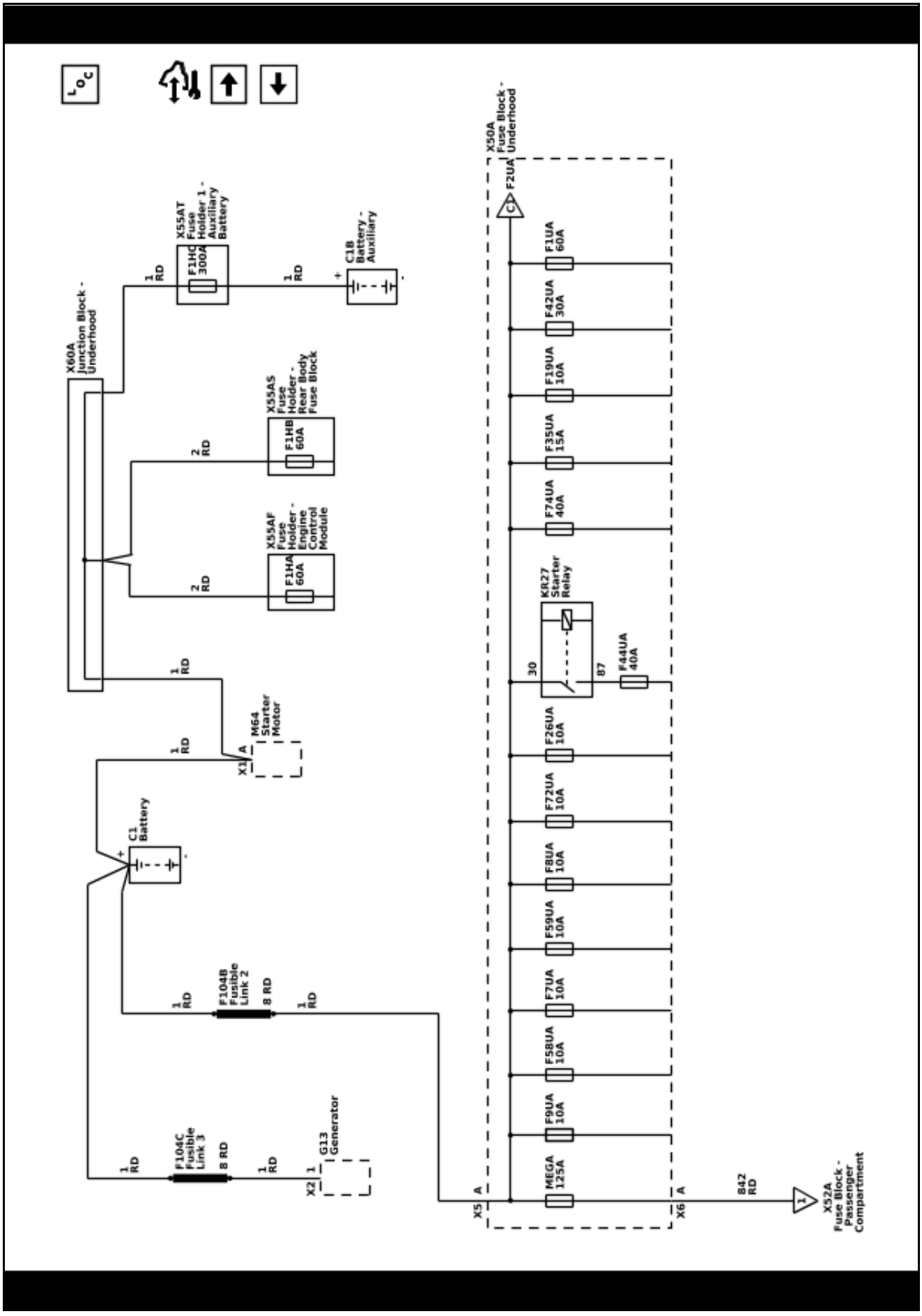
Power Distribution Schematics (Fusible Links and B+ Bus - Underhood Fuse Block (Gas with One Battery, 1 of 3))



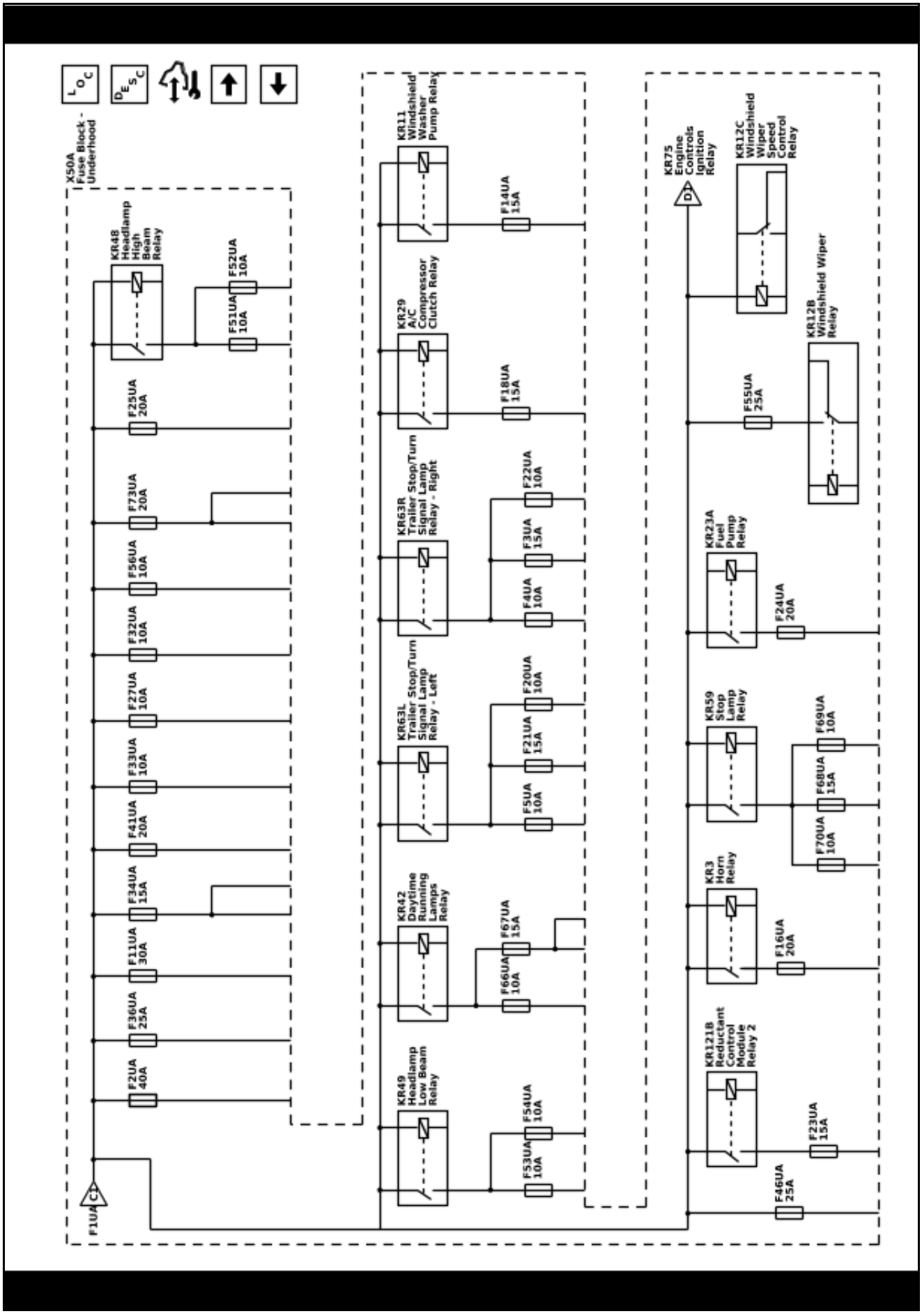
Power Distribution Schematics (Fusible Links and B+ Bus - Underhood Fuse Block (Gas with Two Batteries, 1 of 3) and Fuse Block - Underhood Auxiliary (9L7))



Power Distribution Schematics (Fusible Links and B+ Bus - Underhood Fuse Block (Diesel, 1 of 3))



Power Distribution Schematics (B+ Bus - Underhood Fuse Block (2 of 3))



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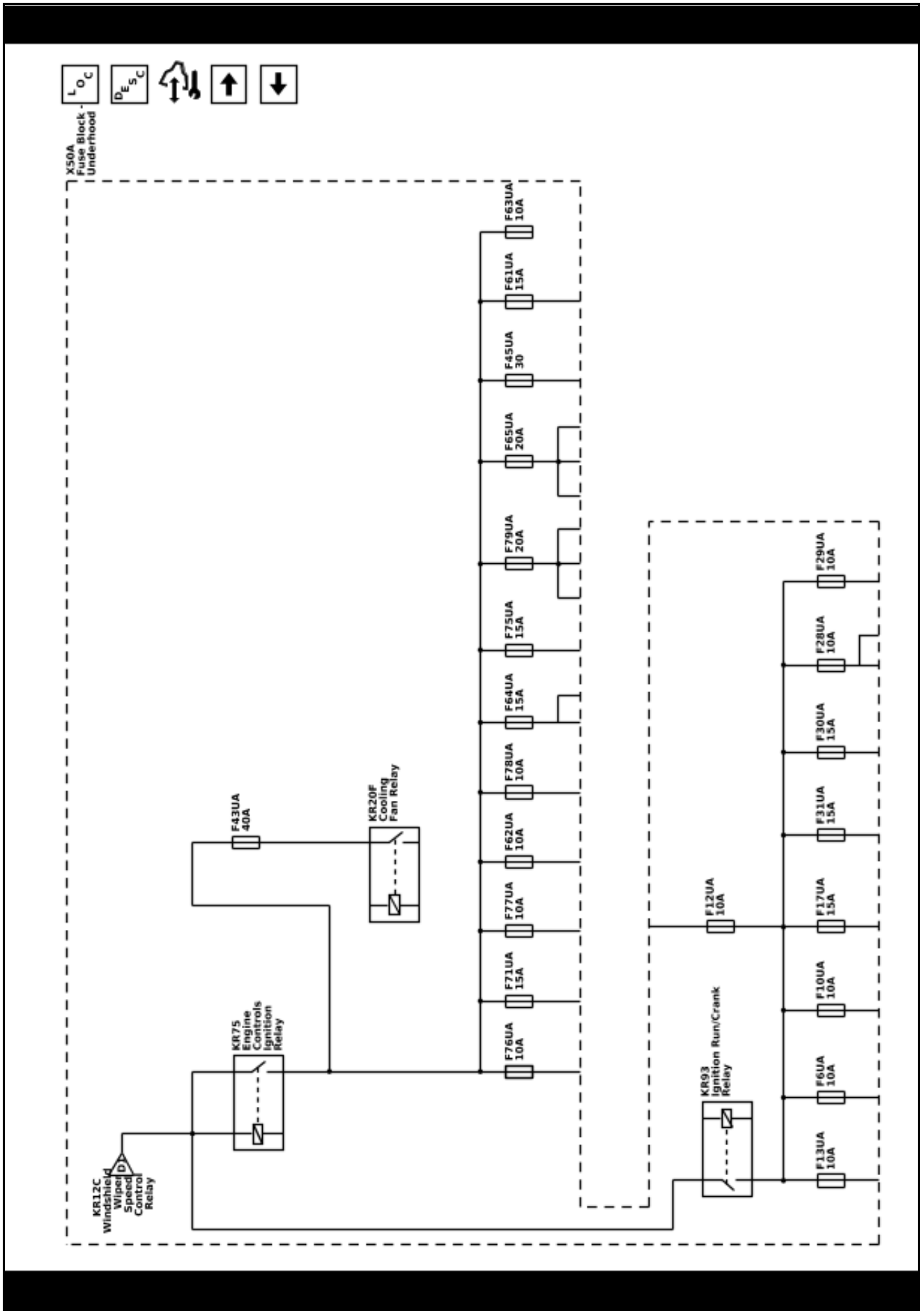
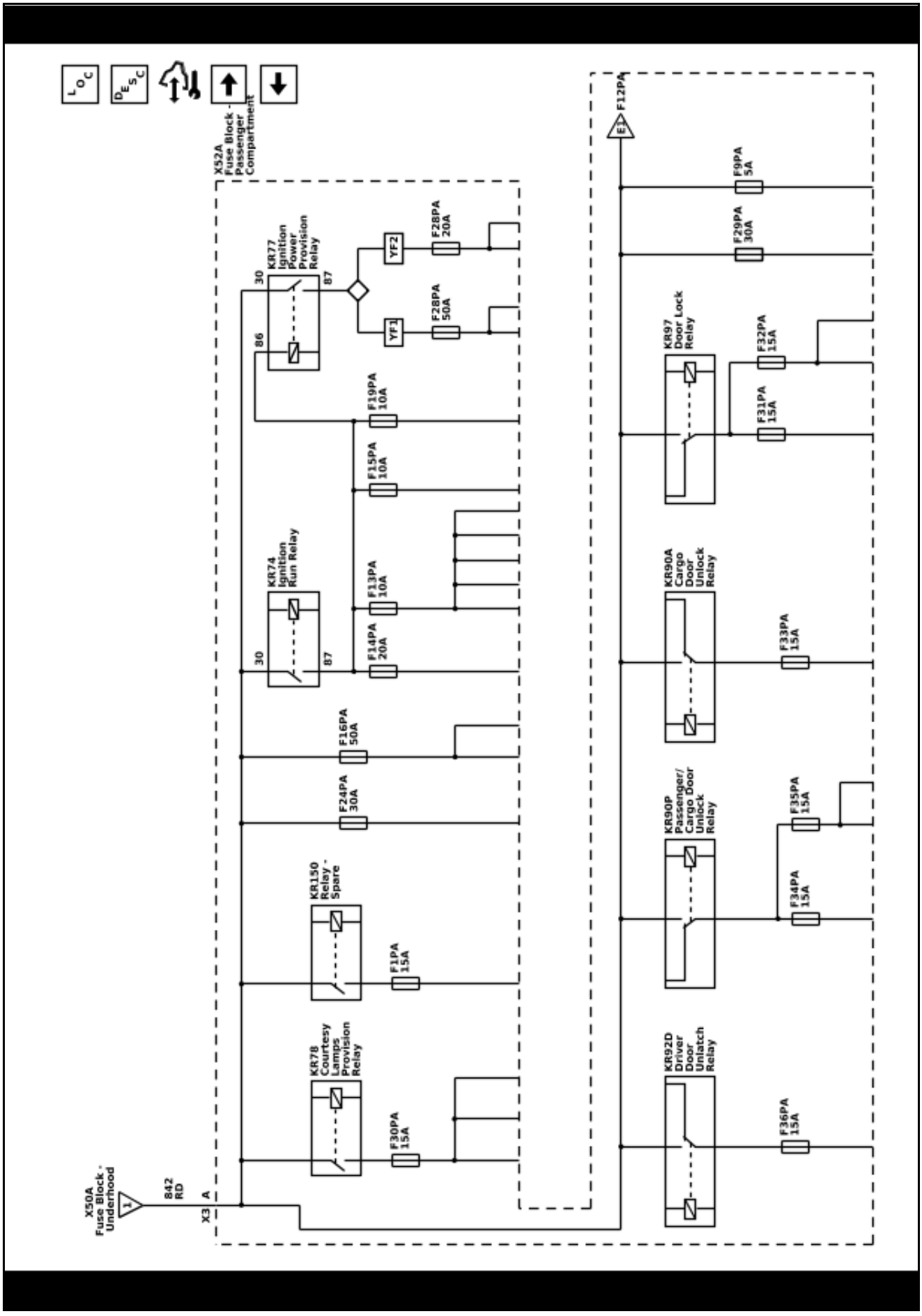
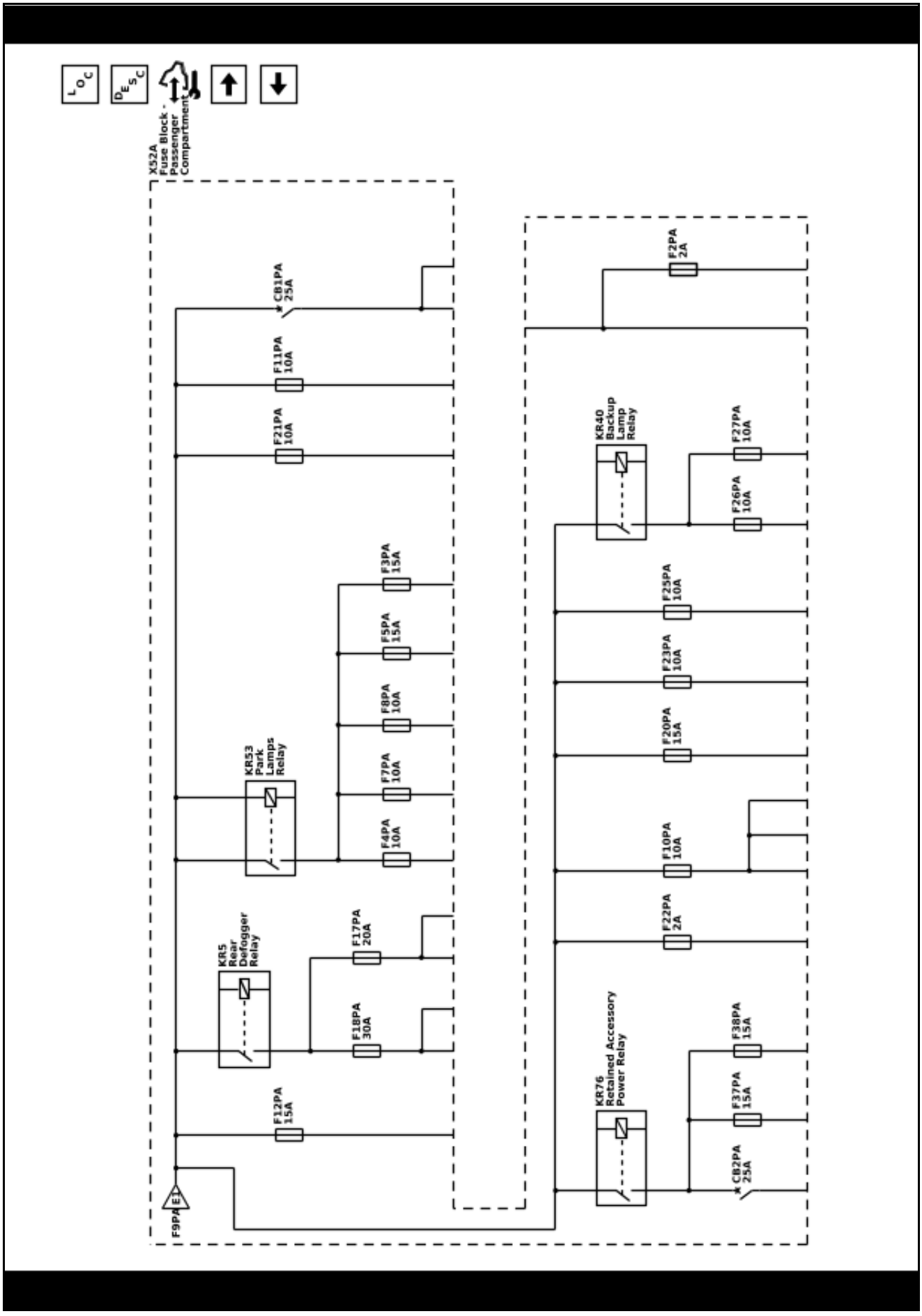
Power Distribution Schematics (B+ Bus - Underhood Fuse Block (3 of 3))



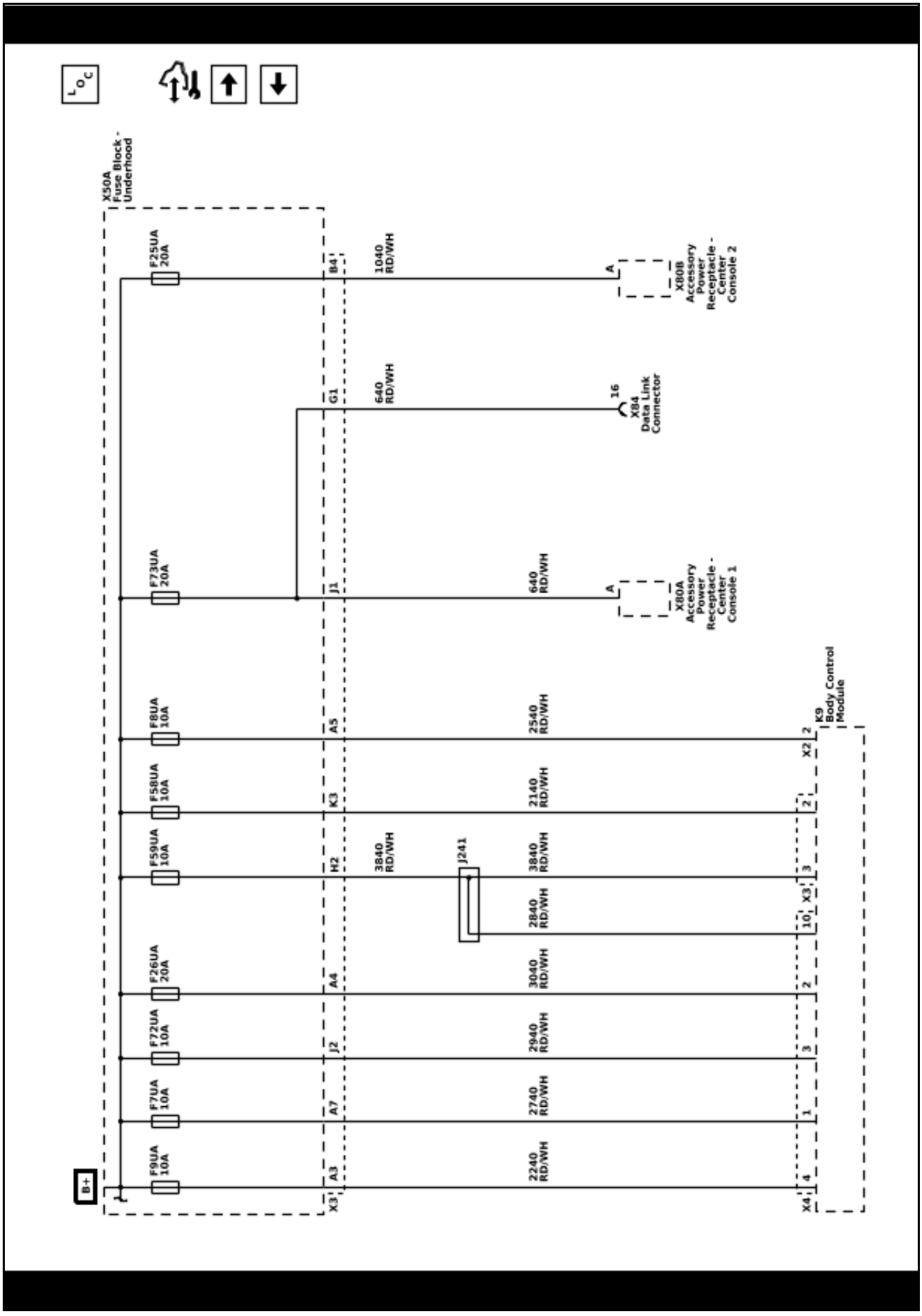
Power Distribution Schematics (B+ Bus - Passenger Compartment Fuse Block (1 of 2))



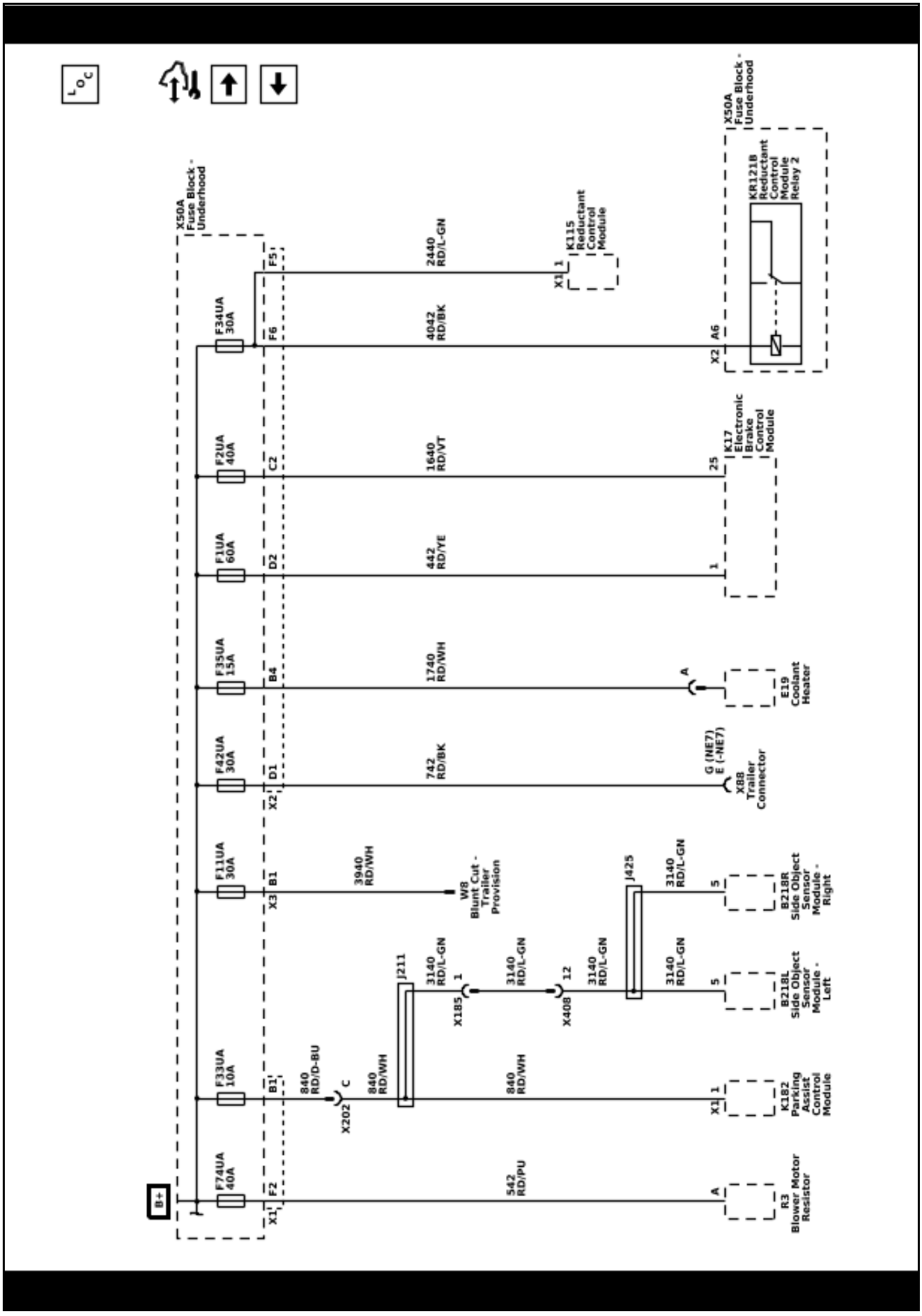
Power Distribution Schematics (B+ Bus - Passenger Compartment Fuse Block (2 of 2))



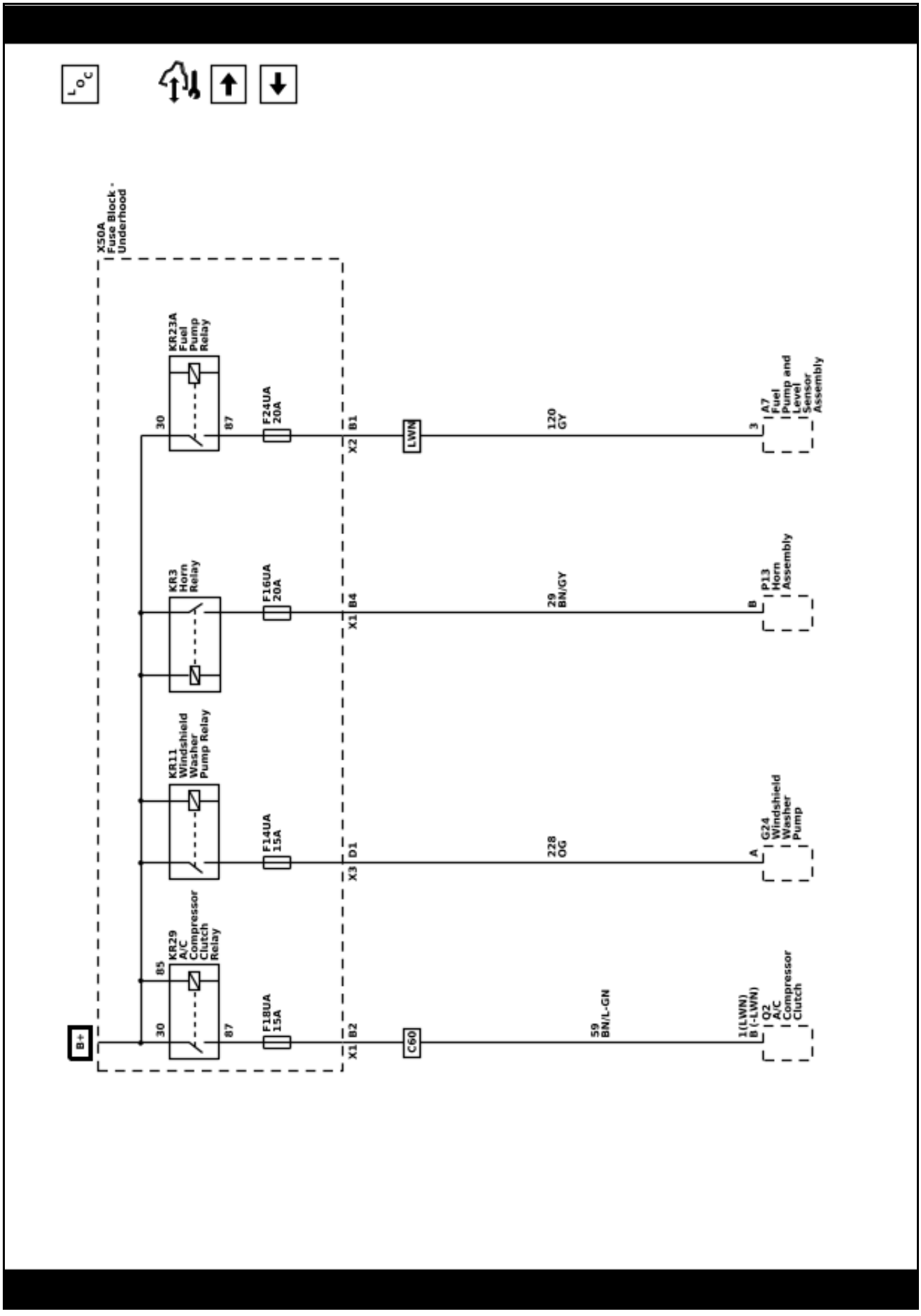
Power Distribution Schematics (Fuses F7UA, F8UA, F9UA, F25UA, F26A, F58UA, F59UA, F72UA, and F73UA)



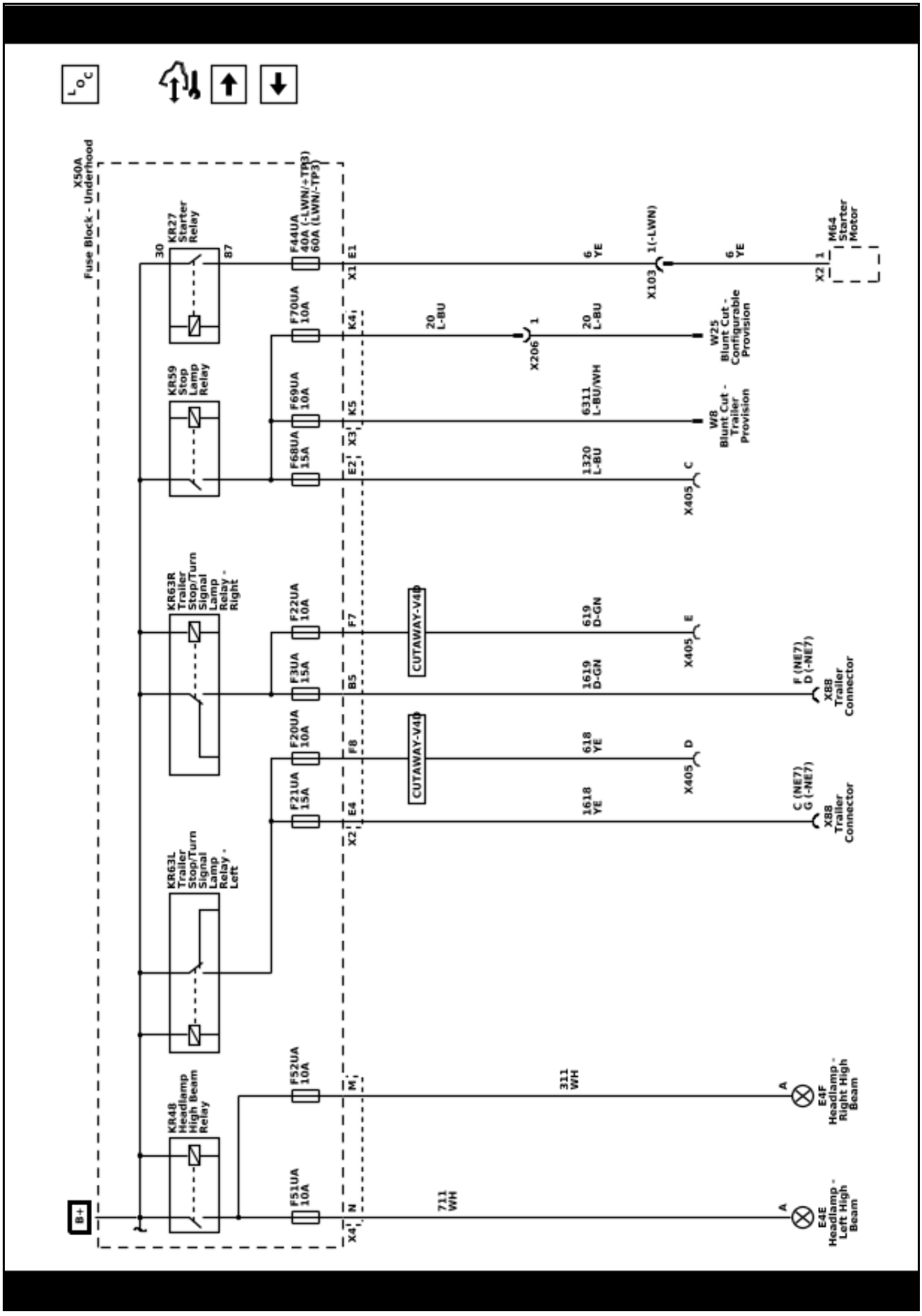
Power Distribution Schematics (Fuses F1UA, F2UA, F11UA, F33UA, F34UA, F35UA, F42UA, and F74UA)



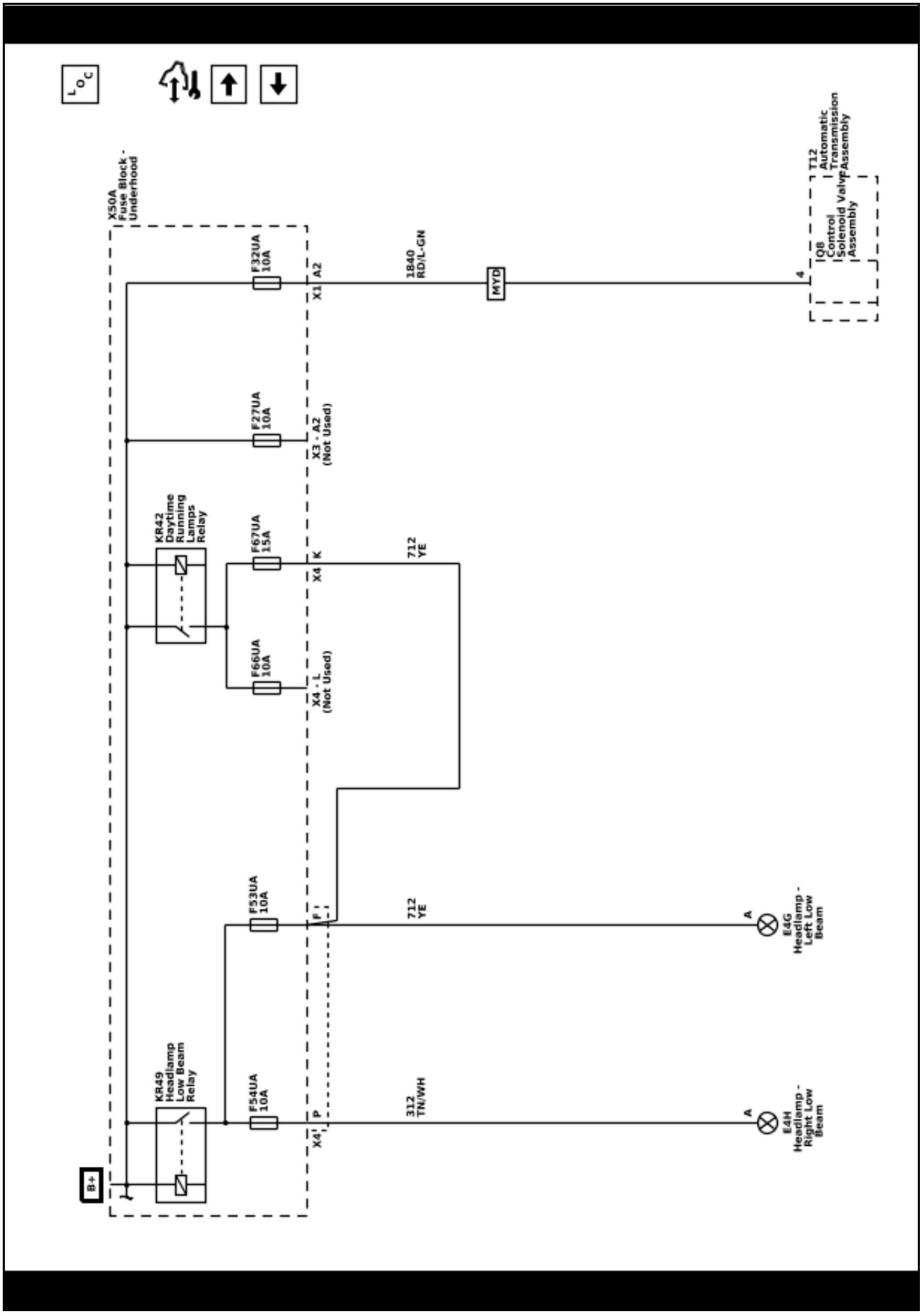
Power Distribution Schematics (Fuses F14UA, F16UA, F18UA, and F24UA)



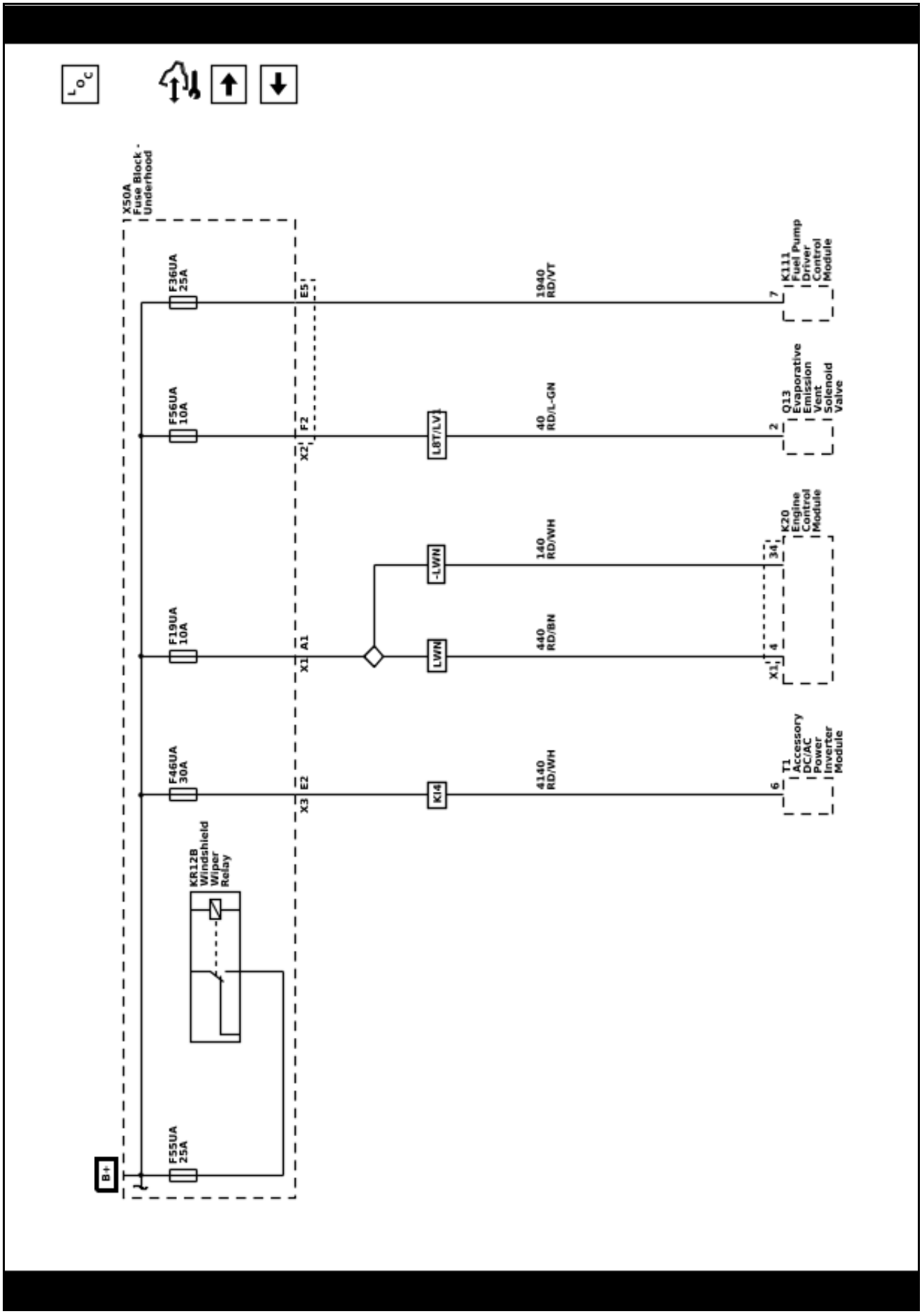
Power Distribution Schematics (Fuses F3UA, F21UA, F44UA, F51UA, F52UA, F68UA, F69UA, and F70UA)



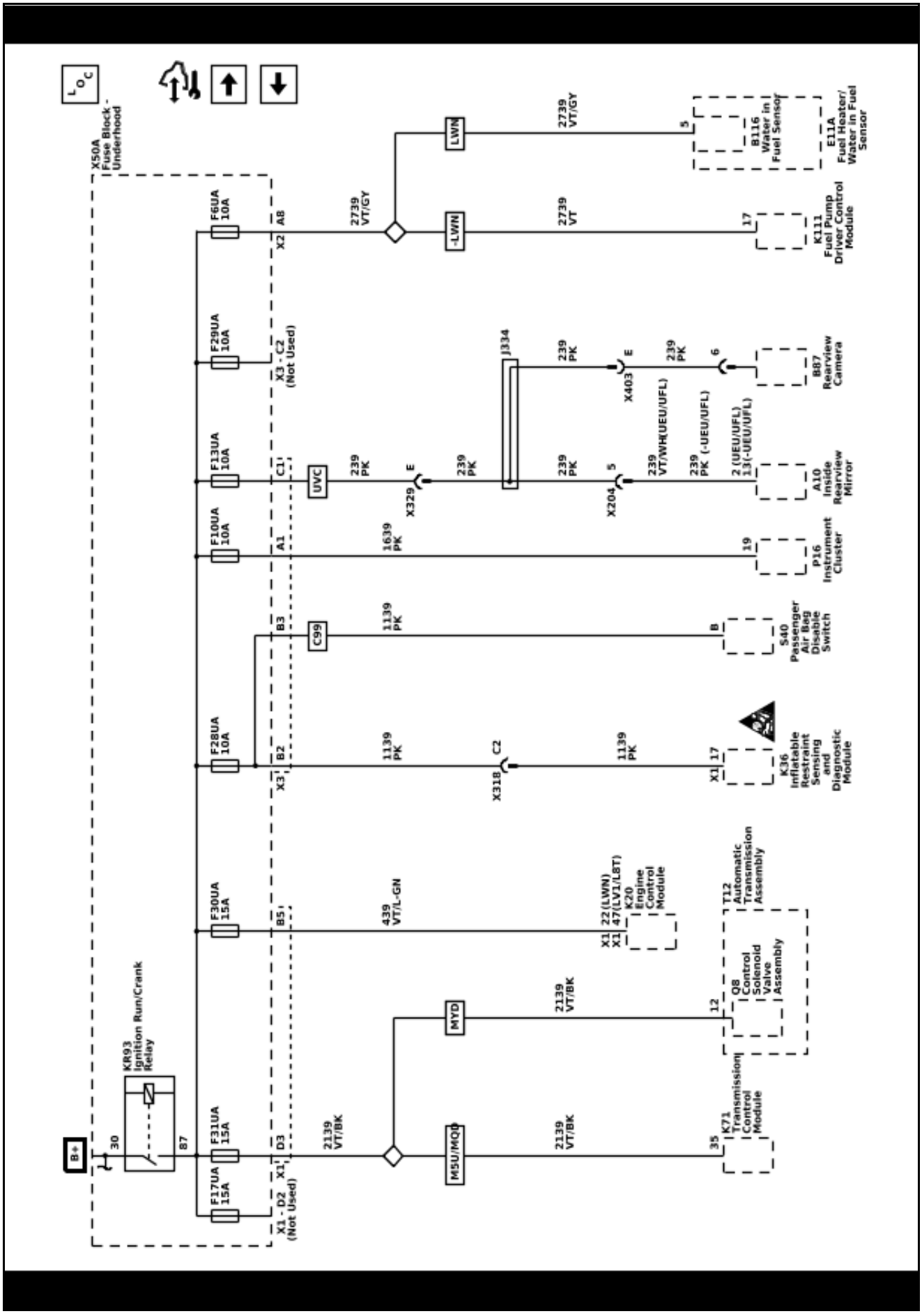
Power Distribution Schematics (Fuses F27UA, F32UA, F53UA, F54UA, F66UA, and F67UA)



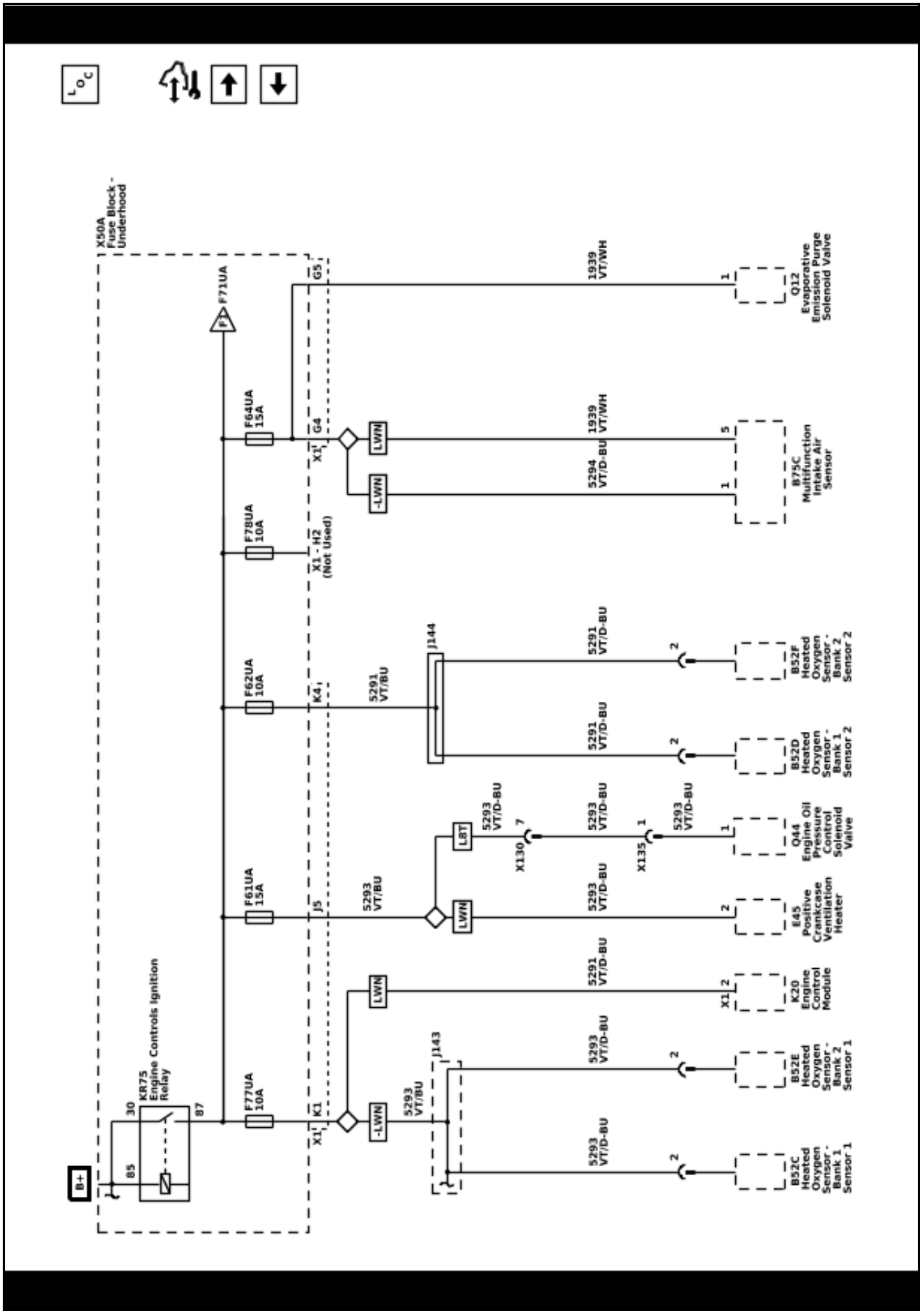
Power Distribution Schematics (Fuses F19UA, F36UA, F46UA, and F56UA)



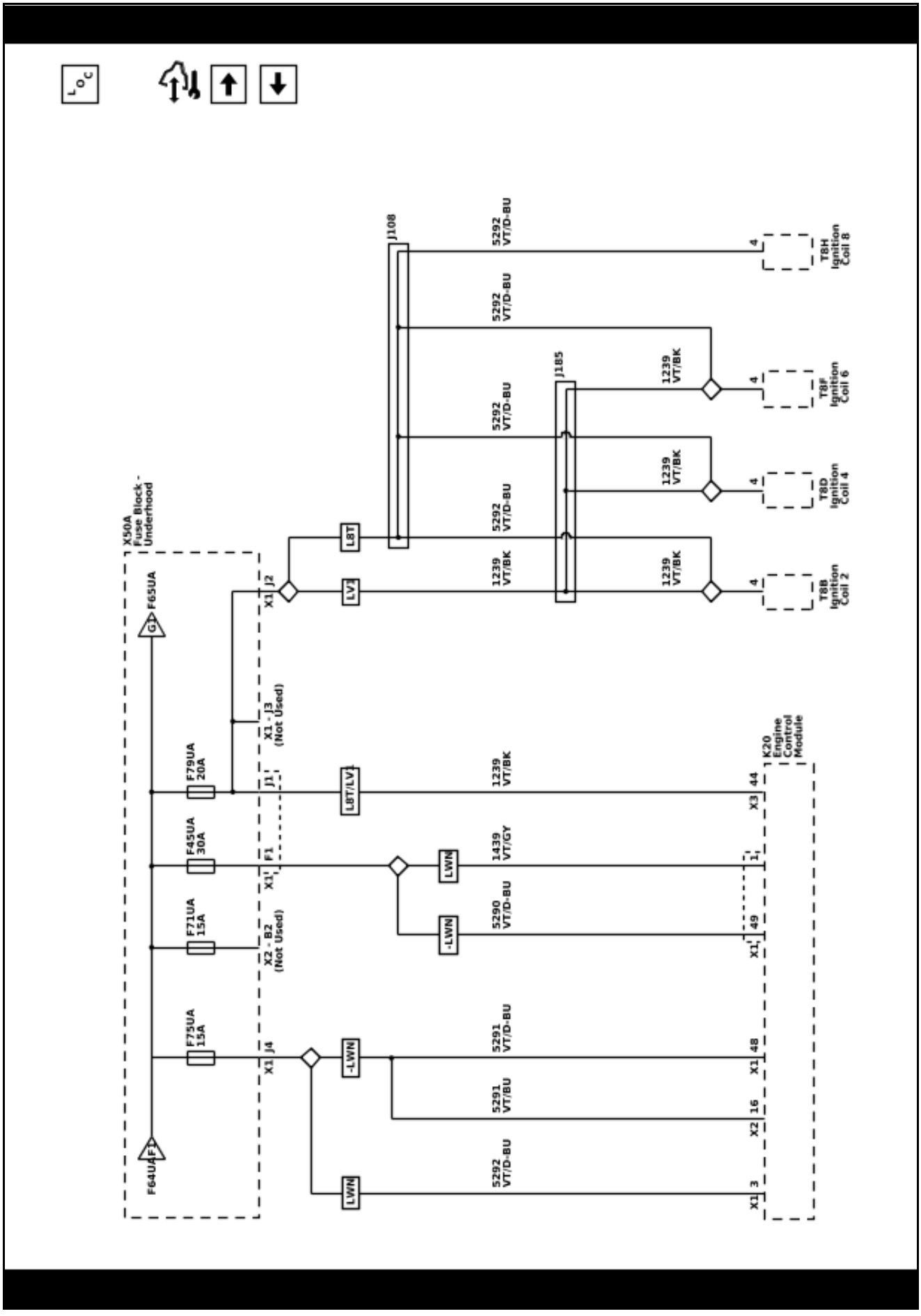
Power Distribution Schematics (Fuses F6UA, F10UA, F17UA, F28UA, F29UA, F30UA, and F31UA)



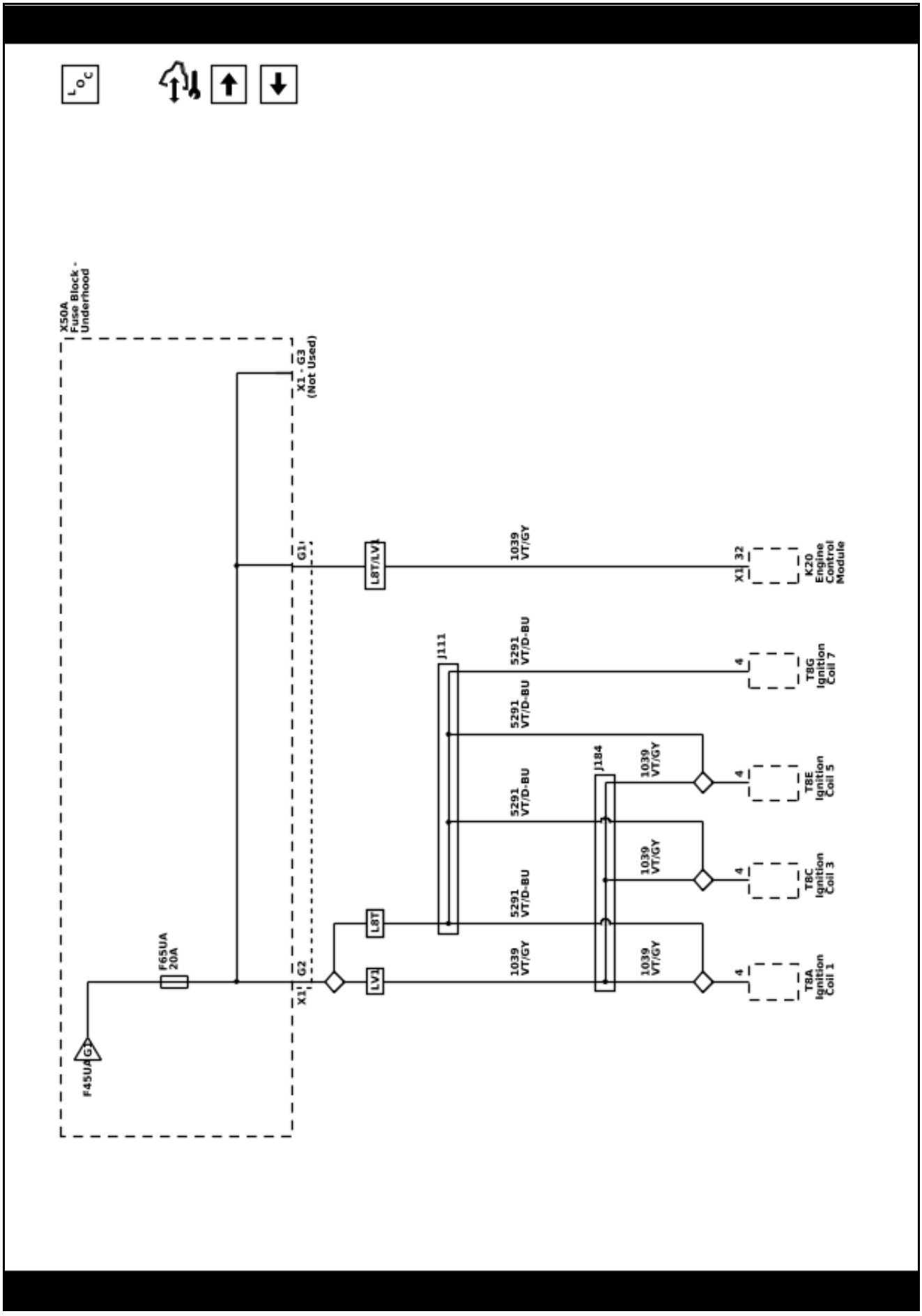
Power Distribution Schematics (Fuses F61UA, F62UA, F64UA, F76UA, F77UA, and F78UA)



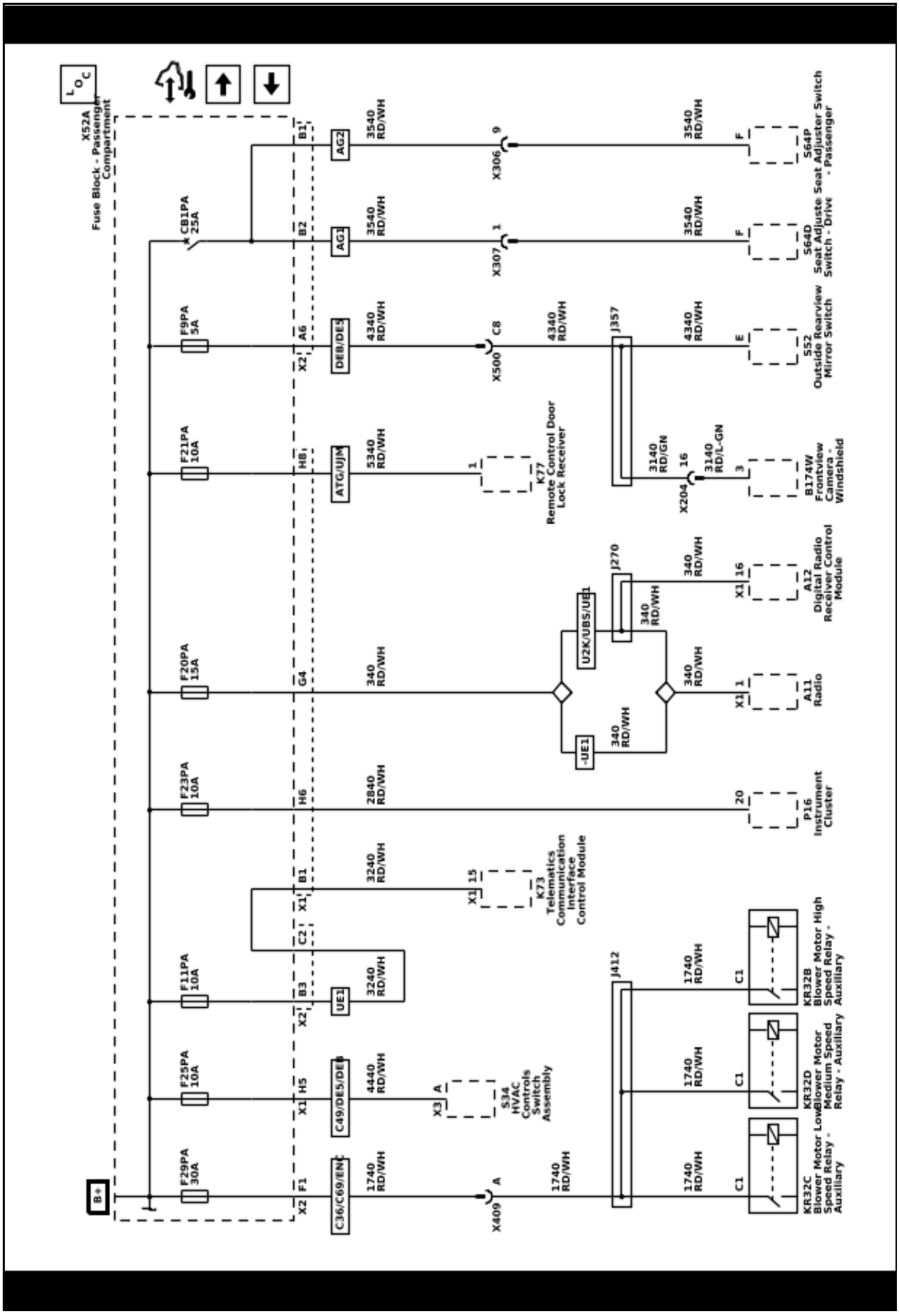
Power Distribution Schematics (Fuses F45UA, F71UA, F75UA, and F79UA)



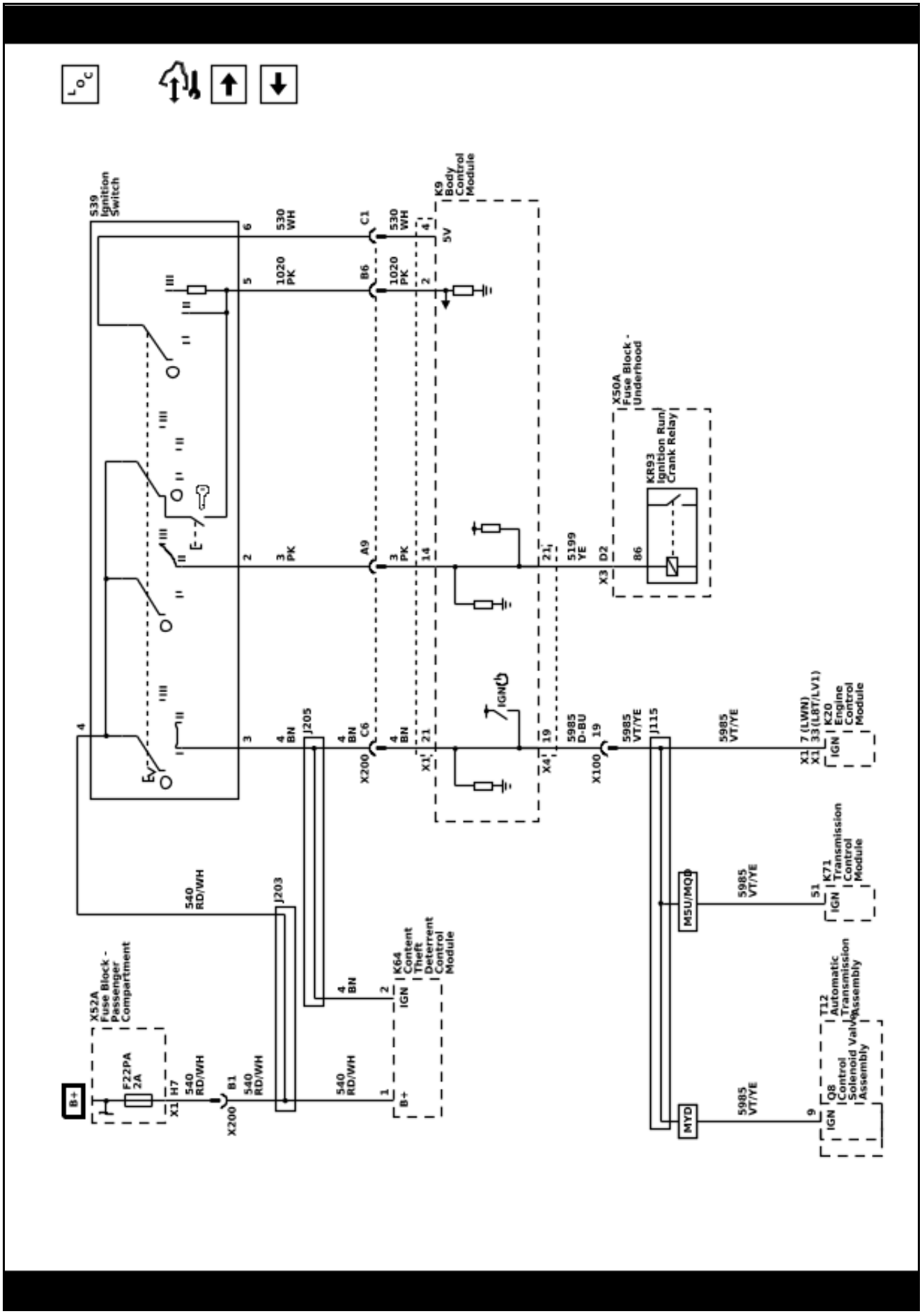
Power Distribution Schematics (Fuse F65UA)



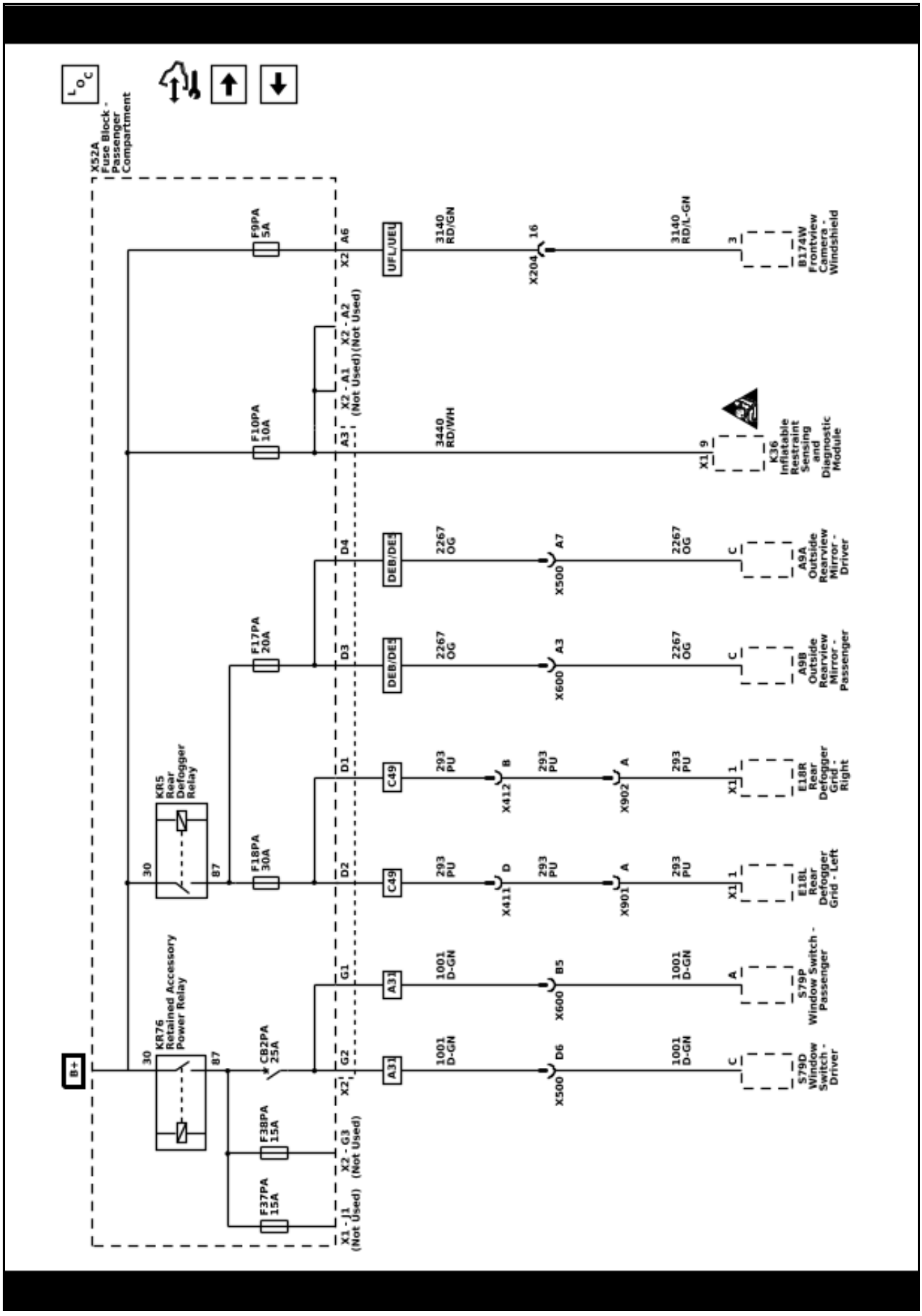
Power Distribution Schematics (Fuses F9PA, F11PA, F20PA, F21PA, F23PA, F25PA, F29PA, and Circuit Breaker CB1PA)



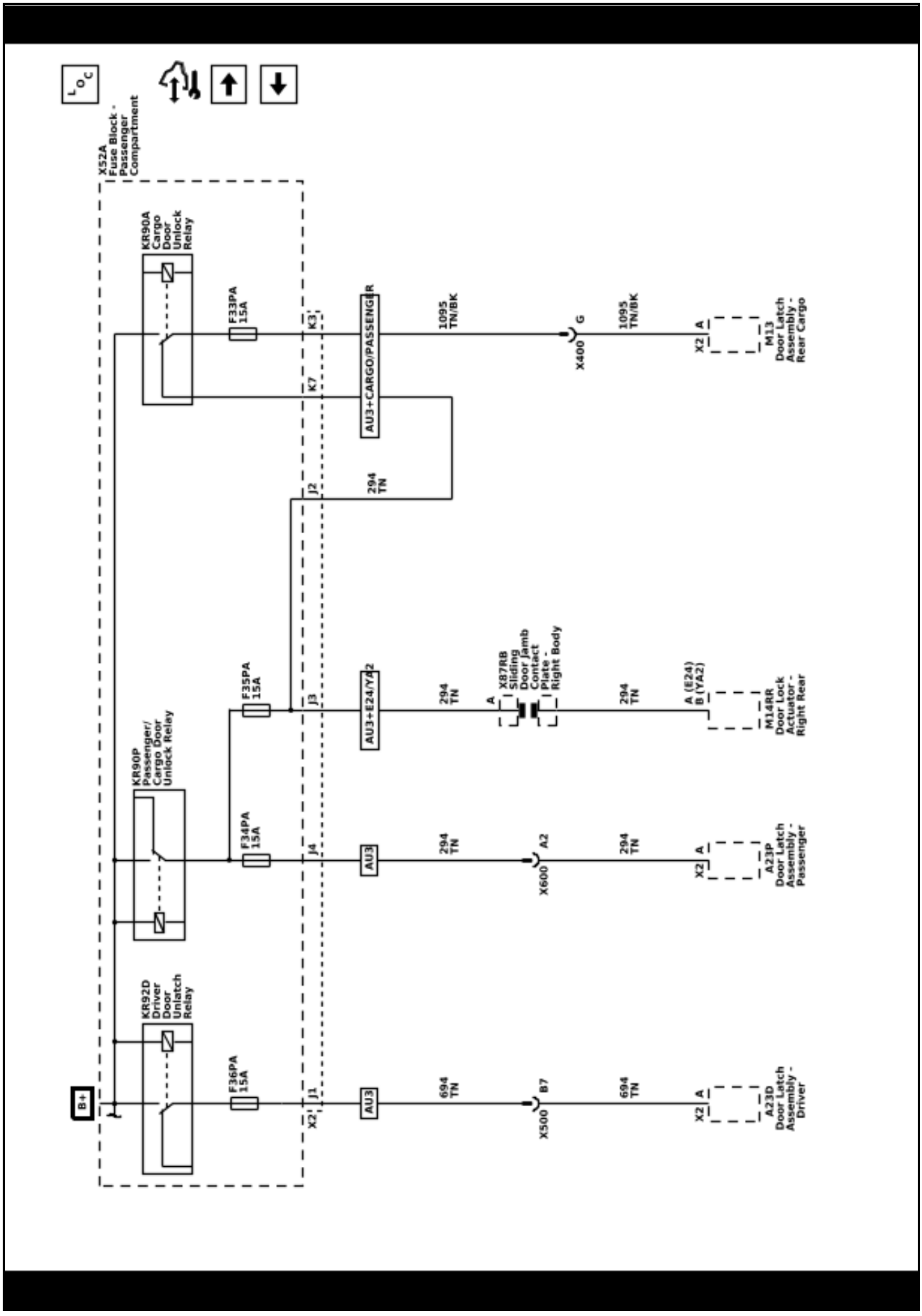
Power Distribution Schematics (Ignition Switch and Fuse F22PA)



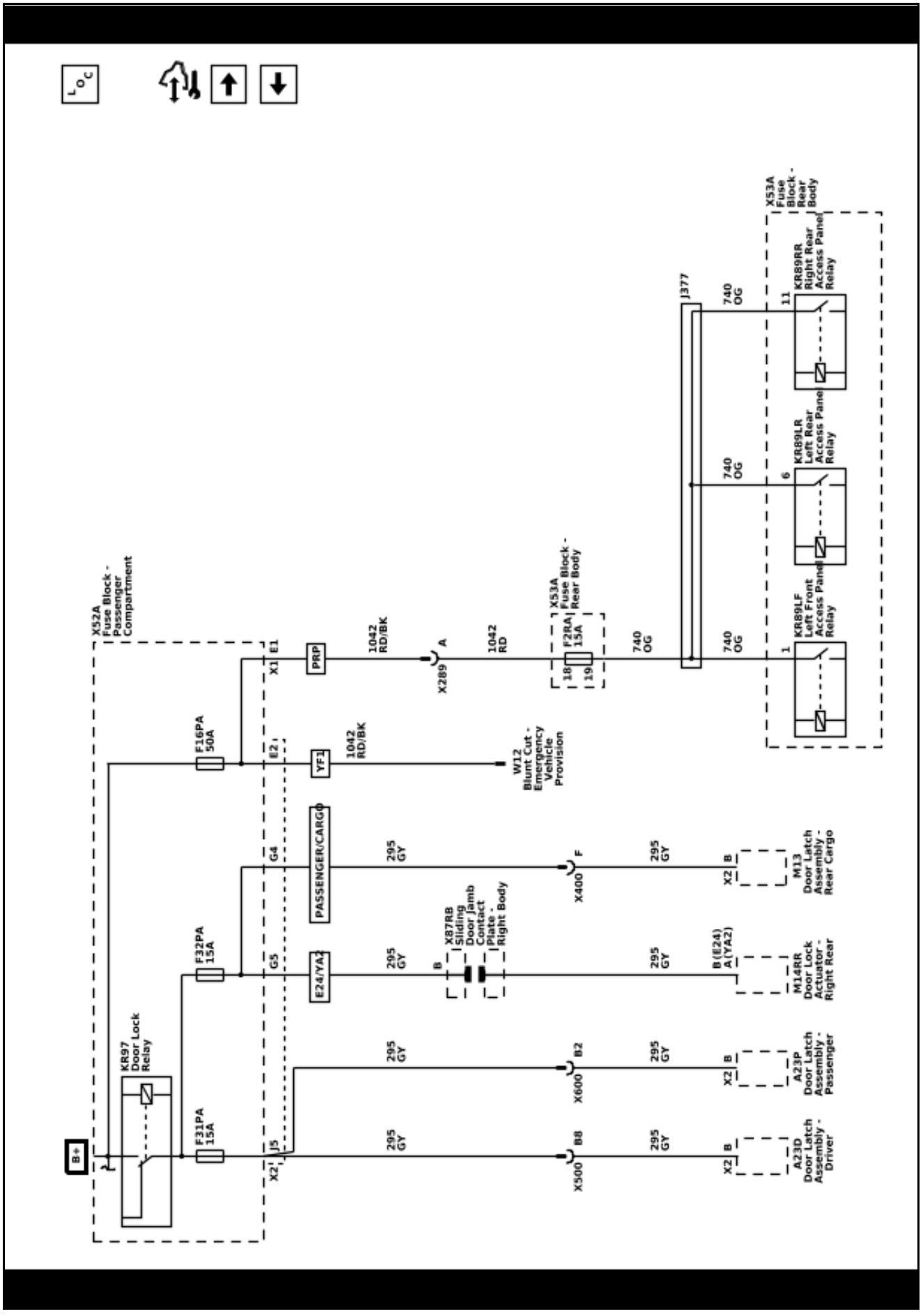
Power Distribution Schematics (Fuses F10PA, F17PA, F18PA, F37PA, F38PA, and Circuit Breaker CB2PA)



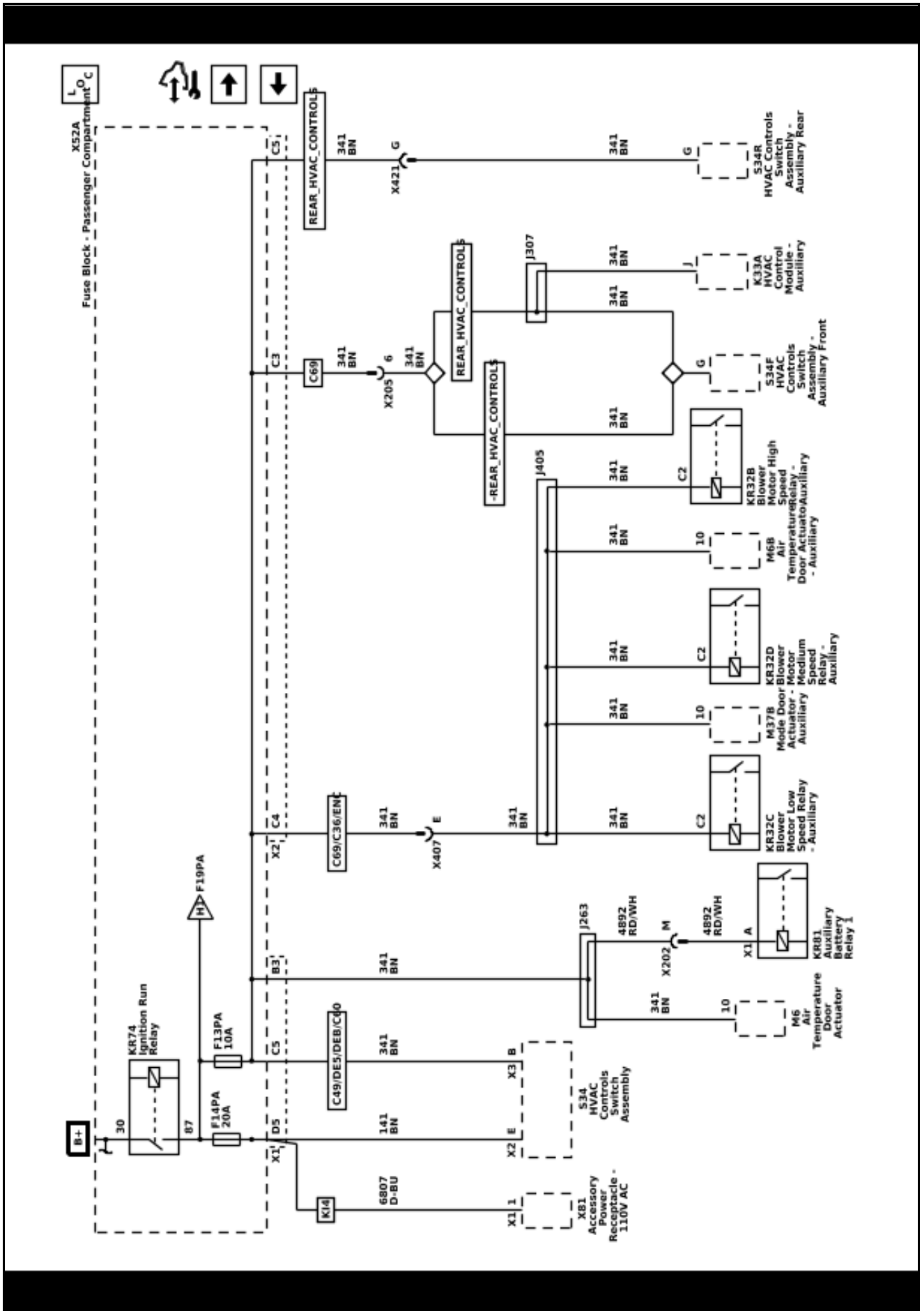
Power Distribution Schematics (Fuses F33PA, F34PA, F35PA, and F36PA)



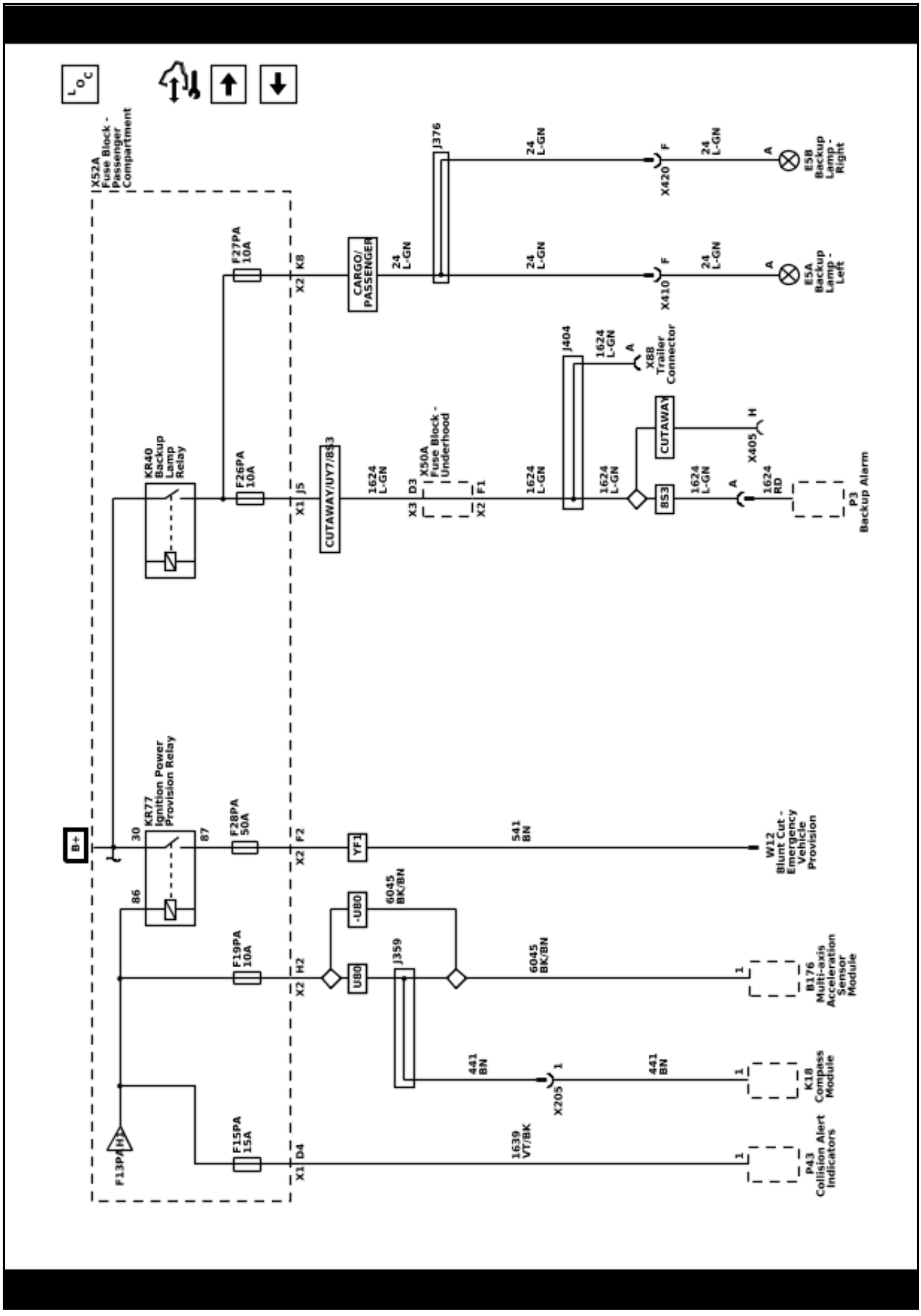
Power Distribution Schematics (Fuses F16PA, F31PA, F32PA, and F2RA)



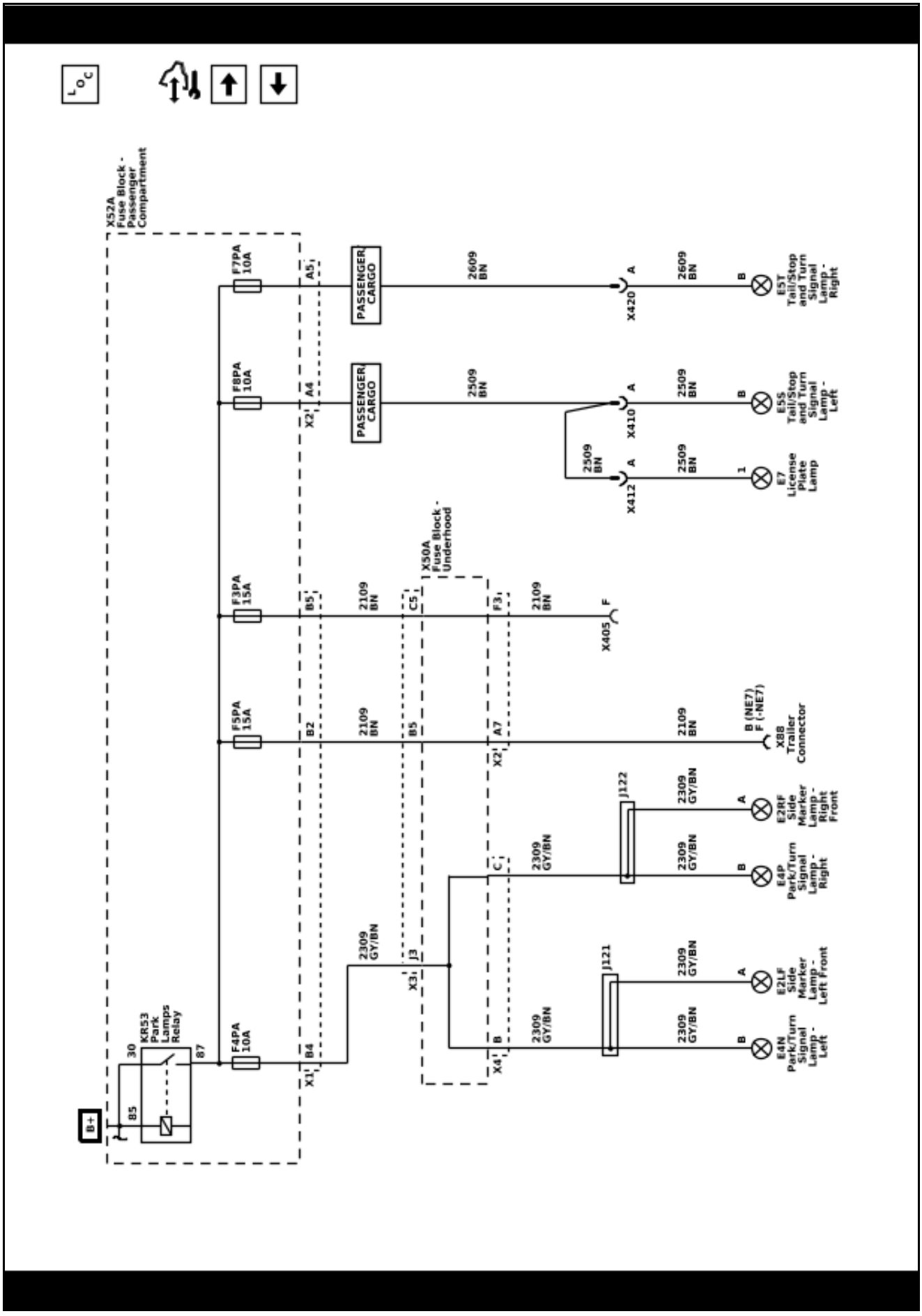
Power Distribution Schematics (Fuses F13PA and F14PA)



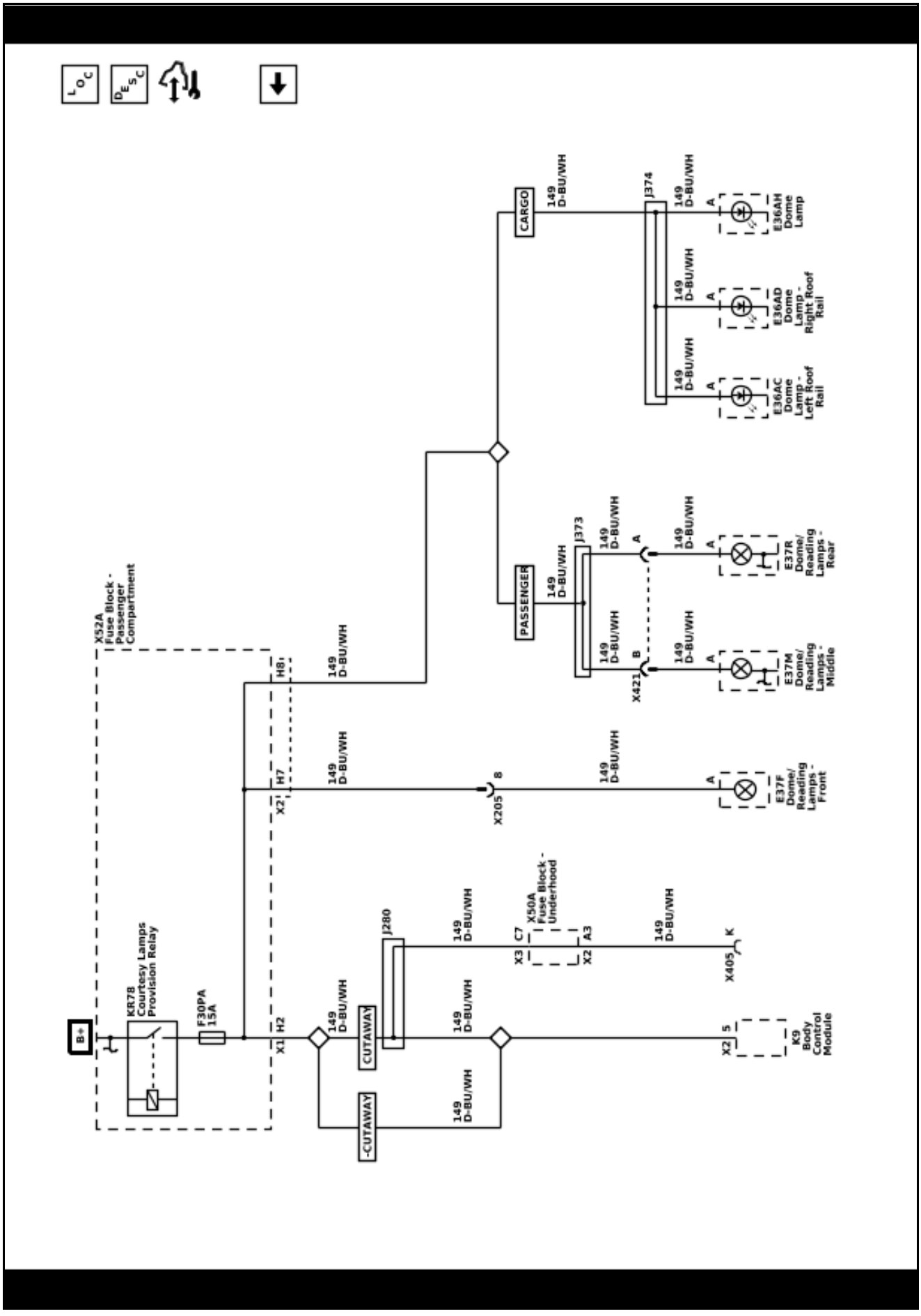
Power Distribution Schematics (Fuses F19PA, F26PA, F27PA, and F28PA)



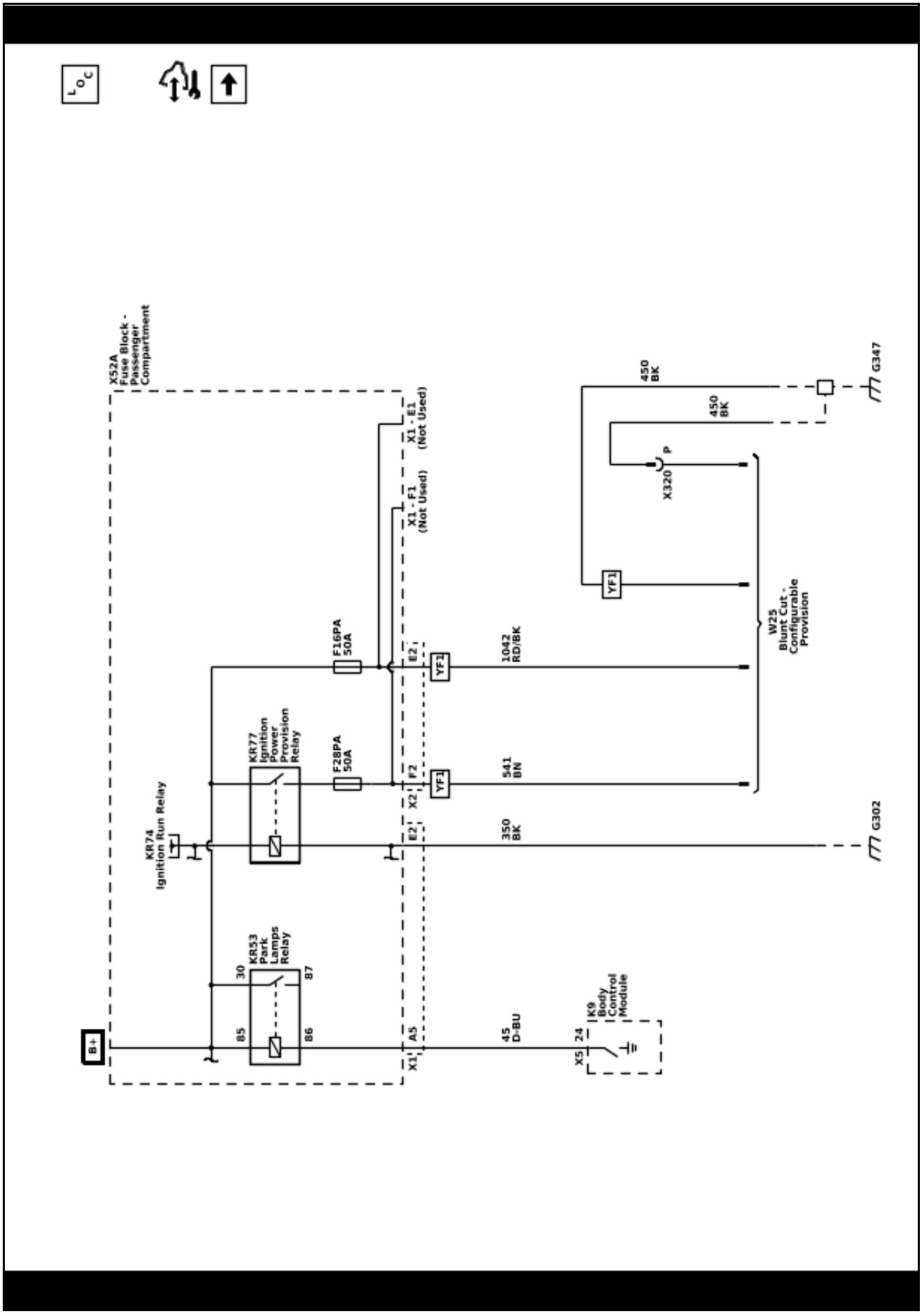
Power Distribution Schematics (Fuses F3PA, F4PA, F5PA, F7PA, and F8PA)



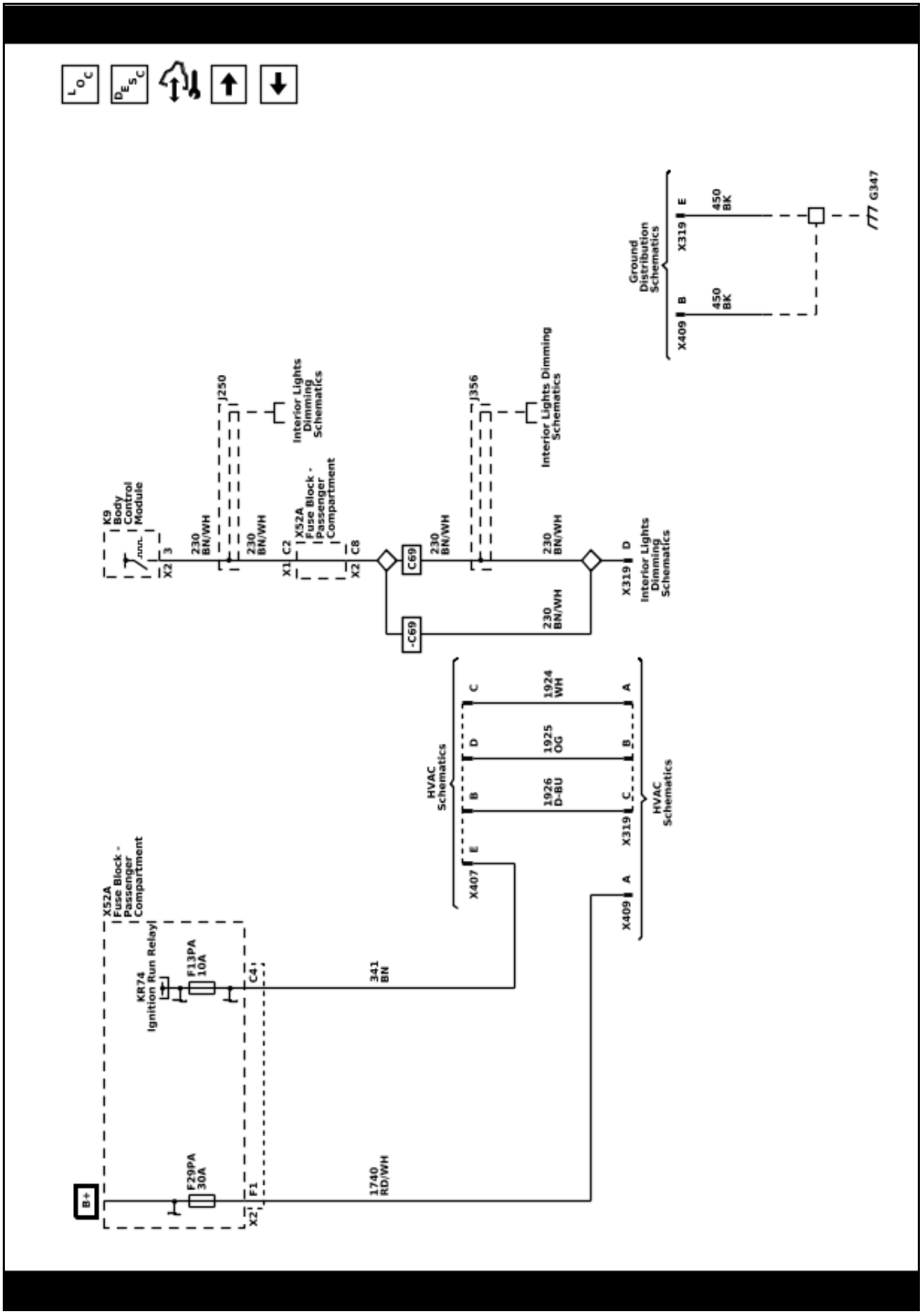
Power Distribution Schematics (Fuse F30PA)



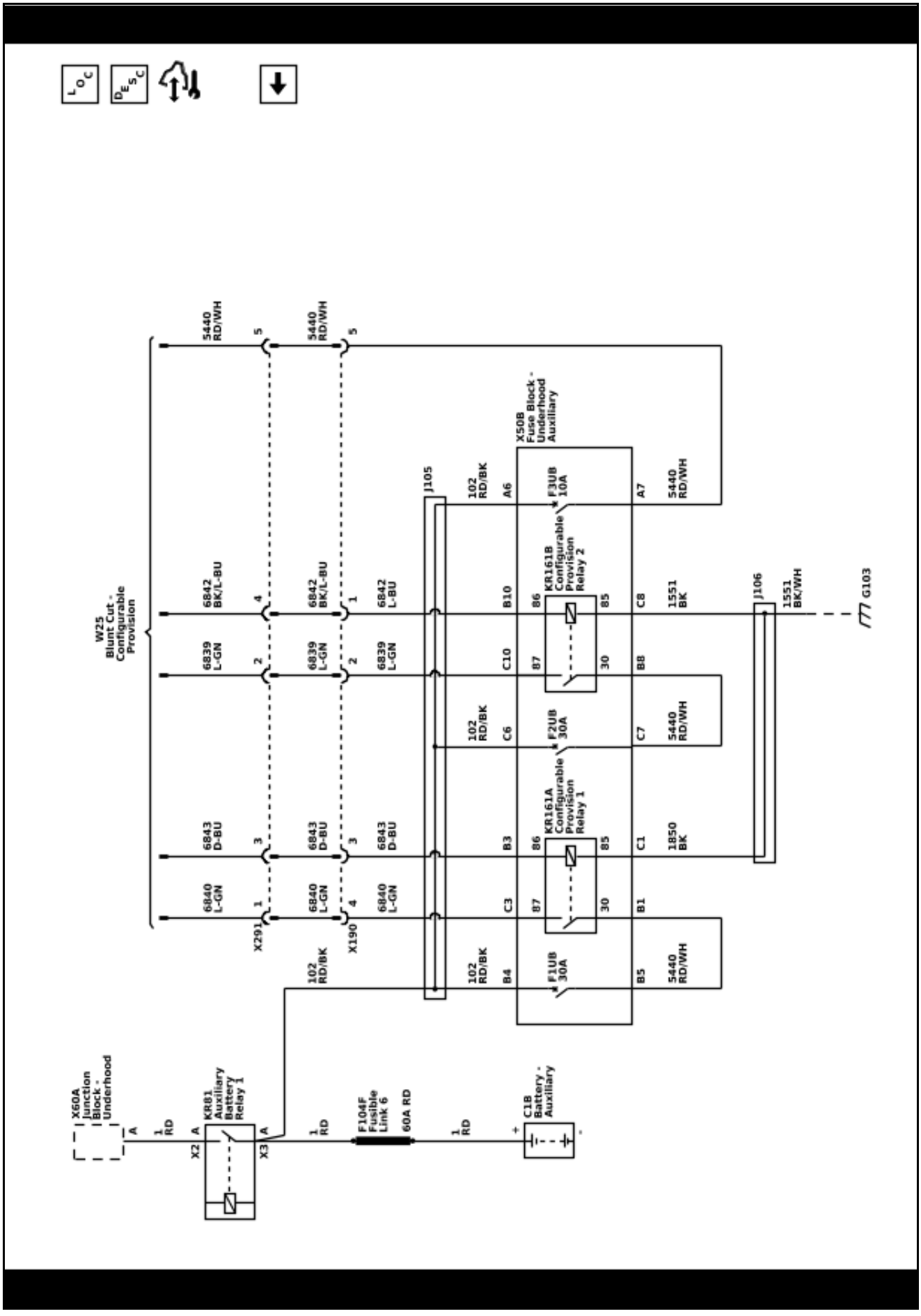
Upfitter Provision Schematics (Power, Ground, and Relay Controls)



Upfitter Provision Schematics (Rear Heat Auxiliary (ENC))



Upfitter Provision Schematics (Upfitter Fuse Block (9L7))



Component Locator

Master Electrical Component List

Code	Name	Option	Location	Locator View	Connector End View
A3L	Sunshade - Left	DH6	On the upper left of the headliner	—	A3L Sunshade - Left
A3R	Sunshade - Right	DH6	On the upper right of the headliner	—	A3R Sunshade - Right
A5	Driver Information Center	—	Integral to P16 Instrument Cluster	—	—
A7	Fuel Pump and Level Sensor Assembly	—	In the vehicle underbody, in the fuel tank	• Fuel Tank Components (NE7) • Fuel Tank Components (Without NE7)	• A7 Fuel Pump and Level Sensor Assembly (L8T/LV1) • A7 Fuel Pump and Level Sensor Assembly (LWN)
A9A	Outside Rearview Mirror - Driver	—	Attached to the exterior of the left front door	Driver Door Components	A9A Outside Rearview Mirror - Driver
A9B	Outside Rearview Mirror - Passenger	—	Attached to the exterior of the right front door	Front Passenger Door Components	A9B Outside Rearview Mirror - Passenger
A10	Inside Rearview Mirror	—	In the passenger compartment, mounted at the top center of the windshield	—	• A10 Inside Rearview Mirror (-(UEU/UFL)) • A10 Inside Rearview Mirror (UEU/UFL)
A11	Radio	—	In the center of the instrument panel	Instrument Panel Components (1 of 2)	• A11 Radio X1 • A11 Radio X2 • A11 Radio X3 • A11 Radio X6
A12	Digital Radio Receiver Control Module	U2K/UBS	In the passenger compartment, mounted on a bracket under driver knee bolster panel	Underside of Instrument Panel Components	A12 Digital Radio Receiver Control Module X1
A23D	Door Latch Assembly - Driver	—	Towards the rear of the driver door	Driver Door Components	• A23D Door Latch Assembly - Driver X1 • A23D Door Latch Assembly - Driver X2
A23P	Door Latch Assembly - Passenger	—	Towards the rear of the passenger door	Front Passenger Door Components	• A23P Door Latch Assembly - Passenger X1 • A23P Door Latch Assembly - Passenger X2
A38	Reductant Pump and Sensor Assembly	LWN	Under the vehicle, toward the rear, inside the reductant fluid tank	Reductant Tank Components	A38 Reductant Pump and Sensor Assembly (LWN)
A91	Mirror Display	UVC	Internal to A10 Inside Rearview Mirror	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B1	A/C Refrigerant Pressure Sensor	C60	On the engine harness in the left rear side of the engine compartment	• Engine Compartment Components (2 of 2) • Front of Engine Compartment Components (1 of 2) • Left Front of the Engine Components (LWN)	B1 A/C Refrigerant Pressure Sensor
B1B	A/C Low Side Pressure Switch	C60	Right rear side of the engine compartment, on the side of the accumulator	• Front of Engine Compartment Components (1 of 2) • Front of Engine Compartment Components (2 of 2)	B1B A/C Low Side Pressure Switch
B5LF	Wheel Speed Sensor - Left Front	—	At the left front wheel	• Frame and Underbody Components (1 of 2) • Front Wheel Speed Sensor Components	B5LF Wheel Speed Sensor - Left Front
B5LR	Wheel Speed Sensor - Left Rear	—	At the left rear wheel, attached to the backing plate	Frame and Underbody Components (1 of 2)	• B5LR Wheel Speed Sensor - Left Rear (R04) • B5LR Wheel Speed Sensor - Left Rear (-R04)
B5RF	Wheel Speed Sensor - Right Front	—	At the right front wheel	• Frame and Underbody Components (1 of 2) • Front Wheel Speed Sensor Components	• B5RF Wheel Speed Sensor - Right Front (LWN) • B5RF Wheel Speed Sensor - Right Front (-LWN)
B5RR	Wheel Speed Sensor - Right Rear	—	At the right rear wheel, attached to the backing plate	Frame and Underbody Components (1 of 2)	• B5RR Wheel Speed Sensor - Right Rear (R04) • B5RR Wheel Speed Sensor - Right Rear (-R04)
B9	Ambient Air Temperature Sensor	—	Attached to the front center of the radiator support	Ambient Air Temperature Sensor (UFA)	• B9 Ambient Air Temperature Sensor (UFA) • B9 Ambient Air Temperature Sensor (-UFA)
B10	Ambient Light Sensor	—	On the top of the instrument panel	Instrument Panel Components (2 of 2)	B10 Ambient Light Sensor
B12A	Transmission Fluid Pressure Switch	MYD	Internal to T12 Automatic Transmission Assembly	—	—
B13	Transmission Fluid Temperature Sensor	—	Internal to T12 Automatic Transmission Assembly	—	—
B14A	Transmission Output Shaft Speed Sensor	—	Internal to T12 Automatic Transmission Assembly	Automatic Transmission Internal Electrical Components	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B14C	Transmission Input Shaft Speed Sensor	—	Internal to T12 Automatic Transmission Assembly	—	—
B14D	Transmission Intermediate Shaft Speed Sensor	M5U/MQD	Under the vehicle, internal to the Transmision Assembly	—	—
B15	Transmission Internal Mode Switch	MYD	Internal to T12 Automatic Transmission Assembly	—	—
B18	Battery Current Sensor	—	Attached to the negative terminal of the battery	—	*B18 Battery Current Sensor (LV1/L8T)*
B19A	Brake Booster Fluid Pressure Alarm Switch	UJ1	In the power steering inlet hose, near the power steering pump	*Brake Booster Fluid Alarm Switches (UJ1)*	*B19A Brake Booster Fluid Pressure Alarm Switch*
B20	Brake Fluid Level Switch	—	Left rear of the engine compartment, attached to the left lower side of the brake fluid reservoir	• *Engine Compartment Components (1 of 2)* • *Upper Left Side of the Engine Components (LV1)*	*B20 Brake Fluid Level Switch*
B22	Brake Pedal Position Sensor	—	Attached to brake pedal assembly	*Instrument Panel Components (2 of 2)*	*B22 Brake Pedal Position Sensor*
B23	Camshaft Position Sensor	—	Front of the engine between the water pump and the crank pulley	• *Left Front Side of the Engine Components (LV1)* • *Right Front of Engine Components (LWN)*	*B23 Camshaft Position Sensor (LWN)*
B24	Mobile Telephone Microphone	UE1	In the passenger compartment, in the overhead console	—	*B24 Mobile Telephone Microphone*
B26	Crankshaft Position Sensor	—	Attached to the lower right rear side of the engine, behind the starter	• *Left Front of the Engine Components (LWN)* • *Right Side of the Engine Components (L8T) (2 of 2)*	*B26 Crankshaft Position Sensor*
B28F	Door Ajar Switch - Right Sliding	Cargo/Passenger	Mounted towards the bottom of the right rear door	• *Front of the Passenger Compartment Components* • *Right Side Hinged Door Components (E24)* • *Right Sliding Door Components (YA2)*	*B28F Door Ajar Switch - Right Sliding*
B33	Engine Coolant Level Switch	LWN	Right front of the engine compartment, attached to the bottom of the coolant surge tank	• *Front of Engine Compartment Components (1 of 2)* • *Front of Engine Compartment Components (2 of 2)*	*B33 Engine Coolant Level Switch (LWN)*

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B34	Engine Coolant Temperature Sensor	—	Attached to the engine coolant thermostat housing	• Left Front Side of the Engine Components (LV1) • Left Side of Engine Components (LWN) • Right Front Side of the Engine Components (LV1)	• B34 Engine Coolant Temperature Sensor (L8T) • B34 Engine Coolant Temperature Sensor (LV1) • B34 Engine Coolant Temperature Sensor (LWN)
B35	Engine Oil Level Switch	—	Attached to the left side of the oil pan	• Right Front of Engine Components (LWN) • Right Front Side of the Engine Components (LV1) • Right Side of the Engine Components (L8T) (2 of 2)	• B35 Engine Oil Level Switch (L8T) • B35 Engine Oil Level Switch (LV1) • B35 Engine Oil Level Switch (LWN)
B36	Engine Oil Temperature Sensor	L8T	In the engine compartmnet, near the left rear of the engine block	—	B36 Engine Oil Temperature Sensor (L8T)
B37B	Engine Oil Pressure Sensor	—	In engine compartment, on the rear lower left side of the engine	• Left Front Side of the Engine Components (LV1) • Right Front of Engine Components (LWN)	B37B Engine Oil Pressure Sensor
B46	Fuel Level Sensor	—	Under the vehicle, in the fuel tank	• Frame and Underbody Components (2 of 2) • Inside of Fuel Tank Components	—
B47	Fuel Pressure Sensor	LV1/L8T	Under the vehicle, near the fuel tank	—	• B47 Fuel Pressure Sensor (Cutaway) • B47 Fuel Pressure Sensor (-Cutaway)
B47B	Fuel Rail Pressure Sensor	—	In the engine compartment, on top of the engine, mounted to the rear of the right fuel rail	• Right Rear of Engine Components (LWN) • Top of the Engine Components (LV1)	• B47B Fuel Rail Pressure Sensor (LWN) • B47B Fuel Rail Pressure Sensor (-LWN)
B48	Fuel Temperature Sensor	LWN	Under the vehicle, near the transmission, located with the fuel filter	—	—
B52C	Heated Oxygen Sensor - Bank 1 Sensor 1	LV1/L8T	Attached to the left front exhaust pipe, front of the catalytic converter	• Exhaust Components (LV1) • Left Side of the Engine Components (L8T)	B52C Heated Oxygen Sensor - Bank 1 Sensor 1
B52D	Heated Oxygen Sensor - Bank 1 Sensor 2	LV1/L8T	Attached to the left front exhaust pipe, back of the catalytic converter	• Exhaust Components (LV1) • Left Side of the Engine Components (L8T)	B52D Heated Oxygen Sensor - Bank 1 Sensor 2

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B52E	Heated Oxygen Sensor - Bank 2 Sensor 1	LV1/L8T	Attached to the right front exhaust pipe, front of the catalytic converter	• Exhaust Components (LV1) • Right Side of the Engine Components (L8T) (2 of 2)	B52E Heated Oxygen Sensor - Bank 2 Sensor 1
B52F	Heated Oxygen Sensor - Bank 2 Sensor 2	LV1/L8T	Attached to the right front exhaust pipe, rear of the catalytic converter	• Exhaust Components (LV1) • Right Side of the Engine Components (L8T) (2 of 2)	B52F Heated Oxygen Sensor - Bank 2 Sensor 2
B55	Engine Hood Switch	BTV	In the center front of the engine compartment, attached to the hood latch assembly	—	B55 Engine Hood Switch
B59	Front Impact Sensor	—	On the lower center of the radiator support	Front of Engine Compartment Components (1 of 2)	B59 Front Impact Sensor
B63LF	Side Impact Sensor - Left Front	ASF	In the left front side door	Driver Door Components	B63LF Side Impact Sensor - Left Front
B63LR	Side Impact Sensor - Left Rear	ASF	In the left center of the vehicle behind the body panel trim	Left Rear Cargo Area Components (Passenger or Cargo)	B63LR Side Impact Sensor - Left Rear
B63RF	Side Impact Sensor - Right Front	ASF	In the right front side door	Front Passenger Door Components	B63RF Side Impact Sensor - Right Front
B63RR	Side Impact Sensor - Right Rear	ASF	In the lower right side of the vehicle near the rear side door	• Right Rear Frame Rail Components (Passenger with E24) • Right Rear Frame Rail Components (Passenger with YA2)	• B63RR Side Impact Sensor - Right Rear (E24) • B63RR Side Impact Sensor - Right Rear (YA2)
B65	Intake Manifold Pressure and Air Temperature Sensor	LWN	In the engine compartment, attached to the intake manifold, on top of the engine	Top of Engine Components (LWN)	B65 Intake Manifold Pressure and Air Temperature Sensor (LWN)
B68A	Knock Sensor 1	LV1/L8T	Mounted to the lower right side of the engine in-between the engine oil pan and the right bank exhaust manifold	• Left Side of the Engine Components (L8T) • Left Side of the Engine Components (LV1)	B68A Knock Sensor 1
B68B	Knock Sensor 2	LV1/L8T	Mounted to the lower left of the engine, in-between the engine oil filter and the left bank exhaust manifold	• Right Front Side of the Engine Components (LV1) • Right Side of the Engine Components (L8T) (2 of 2)	B68B Knock Sensor 2
B74	Manifold Absolute Pressure Sensor	LV1/L8T	In the engine compartment, attached to the intake manifold, on top of the engine	• Left Side of the Engine Components (L8T) • Upper Left Side of the Engine Components (LV1)	B74 Manifold Absolute Pressure Sensor

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B75C	Multifunction Intake Air Sensor	—	Right front of the engine compartment, mounted in the air cleaner duct	• Engine Compartment Components (2 of 2) • Right Rear of Engine Components (LWN) • Upper Left Side of the Engine Components (LV1)	• B75C Multifunction Intake Air Sensor (LWN) • B75C Multifunction Intake Air Sensor (-LWN)
B80	Park Brake Switch	—	Left lower side of the instrument panel on the brake pedal assembly	Instrument Panel Components (2 of 2)	B80 Park Brake Switch
B87	Rearview Camera	UVC	On the right rear cargo door, in license plate trim	Rear Exterior Lights (Passenger or Cargo)	• B87 Rearview Camera (Cutaway) • B87 Rearview Camera (-Cutaway)
B88D	Seat Belt Switch - Driver	—	Right side of the driver seat, inside Seat Belt Buckle — Driver	—	—
B88P	Seat Belt Switch - Passenger	AK5	Left side of the front passenger seat, inside Seat Belt Buckle — Passenger	—	—
B99	Steering Wheel Angle Sensor	—	Attached the lower steering column jacket assembly	Steering Column Components (2 of 2)	B99 Steering Wheel Angle Sensor
B107	Accelerator Pedal Position Sensor	—	Left lower side of the instrument panel, above the accelerator pedal	Instrument Panel Components (2 of 2)	B107 Accelerator Pedal Position Sensor
B116	Water in Fuel Sensor	LWN	In the engine compartment, at the right rear of the engine, mounted in the bottom of the fuel filter	—	—
B130A	Exhaust Gas Recirculation Temperature Sensor 1	LWN	In the engine compartment, on the top left rear side of the engine	Right Rear of Engine Components (LWN)	B130A Exhaust Gas Recirculation Temperature Sensor 1 (LWN)
B130B	Exhaust Gas Recirculation Temperature Sensor 2	LWN	In the engine compartment, on the top right front side of the engine	Right Rear of Engine Components (LWN)	B130B Exhaust Gas Recirculation Temperature Sensor 2 (LWN)
B131A	Exhaust Temperature Sensor 1	LWN	In the engine compartment, attached to the exhaust pipe, on the top left rear side of the engine	Right Rear of Engine Components (LWN)	B131A Exhaust Temperature Sensor 1 (LWN)
B131B	Exhaust Temperature Sensor 2	LWN	Under the vehicle, attached to the exhaust pipe, near the rear of the catalytic converter	Right Rear of Engine Components (LWN)	B131B Exhaust Temperature Sensor 2 (LWN)
B131C	Exhaust Temperature Sensor 3	LWN	Under the vehicle, attached to the exhaust pipe, at the middle of the diesel particulate filter	—	B131C Exhaust Temperature Sensor 3 (LWN)
B131D	Exhaust Temperature Sensor 4	LWN	Under the vehicle, attached to the exhaust pipe, near the rear of the diesel particulate filter	—	B131D Exhaust Temperature Sensor 4 (LWN)
B131E	Exhaust Temperature Sensor 5	LWN	Under the vehicle, attached to the exhaust pipe, after the diesel particulate filter	—	B131E Exhaust Temperature Sensor 5 (LWN)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B133	Brake Booster Fluid Flow Alarm Switch	UJ1	In the power steering outlet hose, near the power steering pump	Brake Booster Fluid Alarm Switches (UJ1)	• B133 Brake Booster Fluid Flow Alarm Switch X1 • B133 Brake Booster Fluid Flow Alarm Switch X2
B134A	Coolant Heater Air Temperature Sensor	K08	Internal to E19 Coolant Heater	Coolant Heater Components (K08)	—
B134B	Coolant Heater Combustion Sensor	K08	Internal to E19 Coolant Heater	Coolant Heater Components (K08)	—
B134C	Coolant Heater Overheat Sensor	K08	Internal to E19 Coolant Heater	Coolant Heater Components (K08)	—
B135	Coolant Heater Temperature Sensor	K08	Internal to E19 Coolant Heater	—	—
B136	Exhaust Particulate Matter Sensor	LWN	Mounted to the exhaust, towards the rear of the engine harness	—	B136 Exhaust Particulate Matter Sensor (LWN)
B150	Fuel Tank Pressure Sensor	L8T/LV1	Attached to the top of the fuel sender assembly	• Fuel Tank Components (NE7) • Fuel Tank Components (Without NE7)	B150 Fuel Tank Pressure Sensor
B153D	Seat Belt Buckle - Driver	—	Right side of the driver seat	Driver Seat Components	B153D Seat Belt Buckle - Driver
B153P	Seat Belt Buckle - Passenger	AK5	Left side of the front passenger seat	Passenger Seat Components	B153P Seat Belt Buckle - Passenger
B154	Diesel Particulate Filter Exhaust Differential Pressure Sensor	LWN	Under the vehicle, near the rear of the catalytic converter	—	B154 Diesel Particulate Filter Exhaust Differential Pressure Sensor (LWN)
B174W	Frontview Camera - Windshield	UFL	In the passenger compartment, mounted at the top center of the windshield	—	B174W Frontview Camera - Windshield
B176	Multi-axis Acceleration Sensor Module	—	In the passenger compartment, on the front center on the floor board between the front seats	Front of the Passenger Compartment Components	B176 Multi-axis Acceleration Sensor Module
B193A	Charge Air Cooler Inlet Temperature Sensor	LWN	In the engine compartment, attached to the intake manifold, front of the turbocharger	Right Rear of Engine Components (LWN)	B193A Charge Air Cooler Inlet Temperature Sensor (LWN)
B193B	Charge Air Cooler Outlet Temperature Sensor	LWN	On the top right front of the engine compartment, near the coolant surge tank	• Front of Engine Compartment Components (2 of 2) • Left Side of Engine Components (LWN)	B193B Charge Air Cooler Outlet Temperature Sensor (LWN)
B194	Reductant Pressure Sensor	LWN	Under the vehicle, above the reductant tank	—	—
B195A	Nitrogen Oxides Sensor 1	LWN	Under the vehicle	Right Rear of Engine Components (LWN)	B195A Nitrogen Oxides Sensor 1 (LWN)
B195B	Nitrogen Oxides Sensor 2	LWN	Under the vehicle	—	B195B Nitrogen Oxides Sensor 2 (LWN)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
B213	Reductant Level Sensor	LWN	Under the vehicle, toward the rear, inside the reductant fluid tank	—	—
B214	Reductant Temperature Sensor	LWN	Under the vehicle, toward the rear, inside the reductant fluid tank	—	—
B218L	Side Object Sensor Module - Left	UFT	At the rear of the vehicle, in the rear bumper, at the left corner	—	B218L Side Object Sensor Module - Left (UFT)
B218R	Side Object Sensor Module - Right	UFT	At the rear of the vehicle, in the rear bumper, at the right corner	—	B218R Side Object Sensor Module - Right (UFT)
B295	Reductant Quality Sensor	LWN	Under the vehicle, mounted to the outboard side of the frame, below the passenger side of the cab attached to the reductant fluid inlet line near the reductant pump and sensor assembly	Reductant Tank Components	B295 Reductant Quality Sensor (LWN)
B303	Transmission Range Sensor	M5U/MQD	Under the vehicle, center, within T12 Automatic Transmission Assembly	—	B303 Transmission Range Sensor (M5U/MQD)
B306E	Parking Assist Sensor - Rear Left Outer	UD7	At the rear of the vehicle, housed in the rear fascia	Rear Exterior Lights (Passenger or Cargo)	B306E Parking Assist Sensor - Rear Left Outer (UD7)
B306F	Parking Assist Sensor - Rear Left Middle	UD7	At the rear of the vehicle, housed in the rear fascia	Rear Exterior Lights (Passenger or Cargo)	B306F Parking Assist Sensor - Rear Left Middle (UD7)
B306G	Parking Assist Sensor - Rear Right Middle	UD7	At the rear of the vehicle, housed in the rear fascia	Rear Exterior Lights (Passenger or Cargo)	B306G Parking Assist Sensor - Rear Right Middle (UD7)
B306H	Parking Assist Sensor - Rear Right Outer	UD7	At the rear of the vehicle, housed in the rear fascia	Rear Exterior Lights (Passenger or Cargo)	B306H Parking Assist Sensor - Rear Right Outer (UD7)
C1	Battery	—	At the right front side of the engine compartment	• Engine Compartment Components (1 of 2) • Front of Engine Compartment Components (2 of 2)	• C1 Battery ((-)) • C1 Battery ((+))
C1B	Battery - Auxiliary	LWN/TP3	Left frame rail, center of the vehicle	Frame and Underbody Components (2 of 2)	• C1B Battery - Auxiliary (LWN) • C1B Battery - Auxiliary (-LWN)
E2LF	Side Marker Lamp - Left Front	—	In the left front corner of the vehicle	Front Exterior Lighting	E2LF Side Marker Lamp - Left Front
E2RF	Side Marker Lamp - Right Front	—	In the right front corner of the vehicle	Front Exterior Lighting	E2RF Side Marker Lamp - Right Front
E4E	Headlamp - Left High Beam	—	At the left front of the vehicle	Front Exterior Lighting	E4E Headlamp - Left High Beam
E4F	Headlamp - Right High Beam	—	At the right front of the vehicle	Front Exterior Lighting	E4F Headlamp - Right High Beam
E4G	Headlamp - Left Low Beam	—	At the left front of the vehicle	Front Exterior Lighting	E4G Headlamp - Left Low Beam
E4H	Headlamp - Right Low Beam	—	At the right front of the vehicle	Front Exterior Lighting	E4H Headlamp - Right Low Beam
E4N	Park/Turn Signal Lamp - Left	—	In the left front corner of the vehicle	Front Exterior Lighting	E4N Park/Turn Signal Lamp - Left

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
E4P	Park/Turn Signal Lamp - Right	—	In the right front corner of the vehicle	Front Exterior Lighting	E4P Park/Turn Signal Lamp - Right
E5A	Backup Lamp - Left	—	Attached to the left tail lamp assembly	Rear Exterior Lights (Passenger or Cargo)	—
E5B	Backup Lamp - Right	—	Attached to the right tail lamp assembly	Rear Exterior Lights (Passenger or Cargo)	—
E5S	Tail/Stop and Turn Signal Lamp - Left	Passenger/Cargo	Attached to the left tail lamp assembly, upper bulb	Rear Exterior Lights (Passenger or Cargo)	—
E5T	Tail/Stop and Turn Signal Lamp - Right	Passenger/Cargo	Attached to the right tail lamp assembly, upper bulb	Rear Exterior Lights (Passenger or Cargo)	—
E6	Center High Mounted Stop Lamp	Passenger/Cargo	At the top rear center of the vehicle	Rear Exterior Lights (Passenger or Cargo)	E6 Center High Mounted Stop Lamp
E7	License Plate Lamp	Passenger/Cargo	Attached to the outer right cargo door, above the license plate mount	Rear Exterior Lights (Passenger or Cargo)	E7 License Plate Lamp
E11	Fuel Heater	LWN	In the engine compartment, at the right rear of the engine, mounted in the bottom of the fuel filter	—	—
E11A	Fuel Heater/Water in Fuel Sensor	LWN	Under the vehicle, near the transmission, located with the fuel filter	—	E11A Fuel Heater/Water in Fuel Sensor (LWN)
E12A	Glow Plug 1	LWN	In the engine compartment, on the top left of the engine	Top of Engine Components (LWN)	E12A Glow Plug 1 (LWN)
E12B	Glow Plug 2	LWN	In the engine compartment, on the top left of the engine	Top of Engine Components (LWN)	E12B Glow Plug 2 (LWN)
E12C	Glow Plug 3	LWN	In the engine compartment, on the top left of the engine	Top of Engine Components (LWN)	E12C Glow Plug 3 (LWN)
E12D	Glow Plug 4	LWN	In the engine compartment, on the top left of the engine	Top of Engine Components (LWN)	E12D Glow Plug 4 (LWN)
E18L	Rear Defogger Grid - Left	C49	Attached to the left cargo door window	Rear Door Components (Passenger or Cargo)	• E18L Rear Defogger Grid - Left X1 • E18L Rear Defogger Grid - Left X2
E18R	Rear Defogger Grid - Right	C49	Attached to the right cargo door window	Rear Door Components (Passenger or Cargo)	• E18R Rear Defogger Grid - Right X1 • E18R Rear Defogger Grid - Right X2
E19	Coolant Heater	K08	Attached to the left front inner frame rail	• Coolant Heater Components (K08) • Frame and Underbody Components (2 of 2)	E19 Coolant Heater (LWN)
E20	Coolant Heater Glow Plug	K08	Internal to E19 Coolant Heater	Coolant Heater Components (K08)	—
E21A	Fluorescent Work Lamp - Right Access Panel	PRP	Mounted towards the right of the top access panel	—	E21A Fluorescent Work Lamp - Right Access Panel
E21F	Fluorescent Work Lamp - Front Cargo	PRP	Mounted towards the top front of the cargo area	—	E21F Fluorescent Work Lamp - Front Cargo

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
E21LF	Fluorescent Work Lamp - Left Front Access Panel	PRP	At the front and towards the top of the left access panel	—	E21LF Fluorescent Work Lamp - Left Front Access Panel
E21LR	Fluorescent Work Lamp - Left Rear Access Panel	PRP	Mounted towards the top of the right access panel	—	E21LR Fluorescent Work Lamp - Left Rear Access Panel
E21R	Fluorescent Work Lamp - Rear Cargo	PRP	Mounted towards the top rear of the cargo area	—	E21R Fluorescent Work Lamp - Rear Cargo
E22	Underhood Lamp	—	In the engine compartment, attached to the left inner hood panel	Underside of Hood Components	E22 Underhood Lamp
E31L	Sunshade Mirror Lamp - Left	DH6	On the upper left of the headliner, inside the Sunshade — Left	Headliner Components	—
E31R	Sunshade Mirror Lamp - Right	DH6	On the upper right of the headliner, in the Sunshade — Right	Headliner Components	—
E36AC	Dome Lamp - Left Roof Rail	Cargo Without YF7	In the rear of the roof panel	—	E36AC Dome Lamp - Left Roof Rail
E36AD	Dome Lamp - Right Roof Rail	Cargo Without YF7	In the rear of the roof panel	—	E36AD Dome Lamp - Right Roof Rail
E36AH	Dome Lamp	Cargo Without YF7	In the rear of the roof panel	—	E36AH Dome Lamp
E37F	Dome/Reading Lamps - Front	Without YF7	In the front of the roof panel	Headliner Components	E37F Dome/Reading Lamps - Front
E37M	Dome/Reading Lamps - Middle	Passenger	In the center of the roof panel	Headliner Components	E37M Dome/Reading Lamps - Middle
E37R	Dome/Reading Lamps - Rear	Passenger	In the rear of the roof panel	Headliner Components	E37R Dome/Reading Lamps - Rear
E45	Positive Crankcase Ventilation Heater	LWN	In the engine compartment, attached to the top front of the engine	Right Front of Engine Components (LWN)	E45 Positive Crankcase Ventilation Heater
E52	Reductant Line Heater	LWN	Under the vehicle, above the reductant tank	Reductant Tank Components	E52 Reductant Line Heater (LWN)
E53	Reductant Tank Heater	LWN	Under the vehicle, inside the reductant tank	—	—
F101	Passenger Instrument Panel Air Bag	—	Right side of the instrument panel	• Instrument Panel Components (1 of 2) • Instrument Panel Components (2 of 2)	F101 Passenger Instrument Panel Air Bag
F105LF	Roof Rail Air Bag - Left Front	ASF	Behind the left side of the headliner trim	Front of the Passenger Compartment Components	F105LF Roof Rail Air Bag - Left Front
F105RF	Roof Rail Air Bag - Right Front	ASF	Behind the right side of the headliner trim	Front of the Passenger Compartment Components	F105RF Roof Rail Air Bag - Right Front
F105RR	Roof Rail Air Bag - Right Rear	ASF	Behind the right rear side of the headliner trim	—	F105RR Roof Rail Air Bag - Right Rear
F106D	Seat Side Air Bag - Driver	AK5	Within the driver seat back, towards the outside	—	F106D Seat Side Air Bag - Driver
F106P	Seat Side Air Bag - Passenger	AK5	Within the passenger seat back, towards the outside	—	F106P Seat Side Air Bag - Passenger

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
F107	Steering Wheel Air Bag	—	Attached to the center of the steering wheel	• Instrument Panel Components (1 of 2) • Steering Column Components (1 of 2)	—
F109D	Seat Belt Buckle Pretensioner - Driver	—	Part of the seat belt buckle	Driver Seat Components	F109D Seat Belt Buckle Pretensioner - Driver
F109P	Seat Belt Buckle Pretensioner - Passenger	AK5	Part of the seat belt buckle	Passenger Seat Components	F109P Seat Belt Buckle Pretensioner - Passenger
G7	Coolant Heater Fuel Pump	K08	Attached to the left inner frame rail, near the fuel pump assembly	• Coolant Heater Components (K08) • Frame and Underbody Components (2 of 2)	G7 Coolant Heater Fuel Pump (LWN)
G12	Fuel Pump	L8T/LV1	Under the vehicle, internally attached to the middle of the fuel pump assembly	Frame and Underbody Components (2 of 2)	—
G13	Generator	—	Attached to the right front of the engine	• Left Front of the Engine Components (LWN) • Right Side of the Engine Components (L8T) (2 of 2)	• G13 Generator X1 • G13 Generator X2 (L8T+KG4+TP3) • G13 Generator X2 (L8T+KG4-TP3) • G13 Generator X2 (L8T+KW5+TP3) • G13 Generator X2 (L8T+KW5-TP3) • G13 Generator X2 (LV1+K68) • G13 Generator X2 (LV1+KW5+TP3) • G13 Generator X2 (LV1+KW5-TP3) • G13 Generator X2 (LWN)
G18	High Pressure Fuel Pump	L8T/LV1	In the engine compartment, at the top rear of the engine, between the cylinder heads	Top of the Engine Components (LV1)	G18 High Pressure Fuel Pump (L8T/LV1)
G24	Windshield Washer Pump	—	Attached to the windshield washer fluid reservoir in the right front of the engine compartment	Front of Engine Compartment Components (1 of 2)	G24 Windshield Washer Pump
G33	Reductant Pump	LWN	Under the vehicle, above the reductant tank	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
K9	Body Control Module	—	Lower right side of the instrument panel behind the knee bolster	Instrument Panel Components (2 of 2)	• K9 Body Control Module X1 • K9 Body Control Module X2 • K9 Body Control Module X3 • K9 Body Control Module X4 • K9 Body Control Module X5 • K9 Body Control Module X6 • K9 Body Control Module X7
K10	Coolant Heater Control Module	K08	Internal to the coolant heater assembly	Coolant Heater Components (K08)	—
K17	Electronic Brake Control Module	—	Attached to the left frame rail, near the center of the vehicle	Frame and Underbody Components (1 of 2)	K17 Electronic Brake Control Module
K18	Compass Module	U80	In the front of the headliner	Headliner Components	K18 Compass Module
K20	Engine Control Module	—	At the left front side of the engine compartment, near the underhood fuse block on the inner left front fender	• Engine Compartment Components (1 of 2) • Engine Compartment Components (2 of 2)	• K20 Engine Control Module X1 (L8T) • K20 Engine Control Module X1 (LV1) • K20 Engine Control Module X1 (LWN) • K20 Engine Control Module X2 (L8T) • K20 Engine Control Module X2 (LV1) • K20 Engine Control Module X2 (LWN) • K20 Engine Control Module X3 (L8T) • K20 Engine Control Module X3 (LV1) • K20 Engine Control Module X3 (LWN)
K33A	HVAC Control Module - Auxiliary	—	In the front of the headliner	—	K33A HVAC Control Module - Auxiliary
K36	Inflatable Restraint Sensing and Diagnostic Module	—	Below the driver seat under the carpet on the floor board	Front of the Passenger Compartment Components	• K36 Inflatable Restraint Sensing and Diagnostic Module X1 • K36 Inflatable Restraint Sensing and Diagnostic Module X2
K64	Content Theft Deterrent Control Module	—	In the steering column around the ignition key cylinder housing	Steering Column Components (1 of 2)	K64 Content Theft Deterrent Control Module

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
K71	Transmission Control Module	M5U	Internal to T12 Automatic Transmission Assembly	Engine Compartment Components (1 of 2)	K71 Transmission Control Module
K73	Telematics Communication Interface Control Module	UE1	In the passenger compartment, mounted on a bracket under driver knee bolster panel	Underside of Instrument Panel Components	• K73 Telematics Communication Interface Control Module X1 • K73 Telematics Communication Interface Control Module X2
K77	Remote Control Door Lock Receiver	ATG/UJM	Attached to the upper left side of the instrument panel carrier, above the instrument panel cluster (IPC)	Instrument Panel Components (2 of 2)	K77 Remote Control Door Lock Receiver
K111	Fuel Pump Driver Control Module	L8T/LV1	Under the vehicle, attached to the left frame rail, apprximately midpoint of vehicle	—	K111 Fuel Pump Driver Control Module (-LWN)
K115	Reductant Control Module	LWN	Under the vehicle, mounted on the top of the reductant fluid tank	Reductant Tank Components	• K115 Reductant Control Module X1 (LWN) • K115 Reductant Control Module X2 (LWN)
K182	Parking Assist Control Module	UD7	In the passenger compartment, mounted within the instrument panel on the right side if the steering column	—	• K182 Parking Assist Control Module X1 • K182 Parking Assist Control Module X2
M2A	Access Panel Unlatch Actuator - Left Front Side Front	PRP	Inside the left access panel area	—	M2A Access Panel Unlatch Actuator - Left Front Side Front
M2B	Access Panel Unlatch Actuator - Left Front Side Rear	PRP	Inside the left access panel area	—	M2B Access Panel Unlatch Actuator - Left Front Side Rear
M2C	Access Panel Unlatch Actuator - Left Rear Side Front	PRP	Inside the left access panel area	—	M2C Access Panel Unlatch Actuator - Left Rear Side Front
M2D	Access Panel Unlatch Actuator - Left Rear Side Rear	PRP	Inside the left access panel area	—	M2D Access Panel Unlatch Actuator - Left Rear Side Rear
M2E	Access Panel Unlatch Actuator - Right Side Front	PRP	Inside the right access panel area	—	M2E Access Panel Unlatch Actuator - Right Side Front
M2F	Access Panel Unlatch Actuator - Right Side Rear	PRP	Inside the right access panel area	—	M2F Access Panel Unlatch Actuator - Right Side Rear
M6	Air Temperature Door Actuator	—	Lower right side of the instrument panel, attached to the HVAC module	HVAC Case Components	M6 Air Temperature Door Actuator
M6B	Air Temperature Door Actuator - Auxiliary	C69	In the left rear of the passenger compartment, attached to the auxiliary HVAC module	Left Rear Cargo Area Components (Passenger or Cargo)	M6B Air Temperature Door Actuator - Auxiliary
M7	Transmission Shift Lock Control Solenoid Actuator	—	Attached to the right side of the steering column	Steering Column Components (1 of 2)	M7 Transmission Shift Lock Control Solenoid Actuator

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
M8	Blower Motor	—	Right rear of the engine compartment, attached to the evaporator case	Engine Compartment Components (1 of 2)	M8 Blower Motor
M8B	Blower Motor - Auxiliary	C36/C69	In the left rear of the passenger compartment, attached to the auxiliary HVAC module	Left Rear Cargo Area Components (Passenger or Cargo)	M8B Blower Motor - Auxiliary
M11	Coolant Heater Blower Motor	K08	Internal to the coolant heater assembly	Coolant Heater Components (K08)	—
M13	Door Latch Assembly - Rear Cargo	Passenger/Cargo	Attached to the right cargo door latch, in the right cargo door	Rear Door Components (Passenger or Cargo)	• M13 Door Latch Assembly - Rear Cargo X1 • M13 Door Latch Assembly - Rear Cargo X2
M14RR	Door Lock Actuator - Right Rear	AU3	Attached to the right rear door latch, in the right rear door	• Right Side Hinged Door Components (E24) • Right Sliding Door Components (YA2)	• M14RR Door Lock Actuator - Right Rear (E24) • M14RR Door Lock Actuator - Right Rear (YA2)
M37B	Mode Door Actuator - Auxiliary	C69	In the left rear of the passenger compartment, attached to the auxiliary HVAC module	Left Rear Cargo Area Components (Passenger or Cargo)	M37B Mode Door Actuator - Auxiliary
M49D	Seat Motor Assembly - Driver	AG1	Below the left front seat, attached to the seat frame	Driver Seat Components	M49D Seat Motor Assembly - Driver (AG1)
M49P	Seat Motor Assembly - Passenger	AG2	Below the right front seat, attached to the seat frame	Passenger Seat Components	M49P Seat Motor Assembly - Passenger (AG2)
M64	Starter Motor	—	Attached to the lower right rear of the engine	• Left Front of the Engine Components (LWN) • Right Front Side of the Engine Components (LV1) • Right Side of the Engine Components (L8T) (1 of 2)	• M64 Starter Motor X1 (L8T+TP3) • M64 Starter Motor X1 (L8T-TP3) • M64 Starter Motor X1 (LV1) • M64 Starter Motor X1 (LWN) • M64 Starter Motor X2
M74D	Window Motor - Driver	A31	Attached to the interior of the left front door	Driver Door Components	M74D Window Motor - Driver
M74P	Window Motor - Passenger	A31	Attached to the interior of the right front door	Front Passenger Door Components	M74P Window Motor - Passenger
M75	Windshield Wiper Motor	—	In the left side of the cowl, near the engine compartment	Front of Engine Compartment Components (1 of 2)	M75 Windshield Wiper Motor
M103	Turbocharger Vane Position Actuator	LWN	In the engine compartment, attached to the turbocharger	Right Rear of Engine Components (LWN)	M103 Turbocharger Vane Position Actuator
P3	Backup Alarm	8S3	In the rear of the vehicle on the frame	—	P3 Backup Alarm
P13	Horn Assembly	—	In the left front engine compartment behind the left headlamp	• Engine Compartment Components (2 of 2) • Front of Engine Compartment Components (1 of 2)	P13 Horn Assembly

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
P16	Instrument Cluster	—	Attached to the left side of the instrument panel	Instrument Panel Components (1 of 2)	P16 Instrument Cluster
P19AG	Speaker - Left Front Door	—	Attached to the left front door	Driver Door Components	P19AG Speaker - Left Front Door
P19AH	Speaker - Right Front Door	—	Attached to the right front door	Front Passenger Door Components	P19AH Speaker - Right Front Door
P19F	Speaker - Left Rear Cargo Door	US8	Attached to the left cargo door	Rear Door Components (Passenger or Cargo)	P19F Speaker - Left Rear Cargo Door
P19LR	Speaker - Left Rear Roof	Cargo/Passenger	In the left rear headliner of the vehicle	Rear Door Components (Passenger or Cargo)	P19LR Speaker - Left Rear Roof
P19RR	Speaker - Right Rear Roof	Cargo/Passenger	In the right rear upper headliner of the vehicle	Rear Door Components (Passenger or Cargo)	P19RR Speaker - Right Rear Roof
P19T	Speaker - Right Rear Cargo Door	US8	Attached to the right cargo door	Rear Door Components (Passenger or Cargo)	P19T Speaker - Right Rear Cargo Door
P34D	Side Object Detection Indicator - Driver	UFT	Internal to the outside rearview mirror - driver	—	—
P34P	Side Object Detection Indicator - Passenger	UFT	Internal to the outside rearview mirror - passenger	—	—
P43	Collision Alert Indicators	UFL	Within the instrument cluster	—	P43 Collision Alert Indicators
Q1A	1-2 Shift Solenoid Valve	MYD	Internal T12 Automatic Transmission Assembly	—	—
Q1B	2-3 Shift Solenoid Valve	MYD	Internal T12 Automatic Transmission Assembly	—	—
Q2	A/C Compressor Clutch	C60	On the front of the A/C compressor lower right front of engine	• Front of Engine Compartment Components (1 of 2) • Left Front of the Engine Components (LWN) • Right Side of the Engine Components (L8T) (2 of 2)	• Q2 A/C Compressor Clutch (LWN) • Q2 A/C Compressor Clutch (-LWN)
Q6	Camshaft Position Actuator Solenoid Valve	L8T/LV1	Front of the engine behind the center of the water pump	Left Front Side of the Engine Components (LV1)	Q6 Camshaft Position Actuator Solenoid Valve
Q8	Control Solenoid Valve Assembly	—	Internal to T12 Automatic Transmission Assembly	Automatic Transmission Internal Electrical Components	—
Q12	Evaporative Emission Purge Solenoid Valve	L8T/LV1	On the top of the engine, rear of the throttle body	• Left Side of the Engine Components (L8T) • Upper Left Side of the Engine Components (LV1)	Q12 Evaporative Emission Purge Solenoid Valve (L8T/LV1)
Q13	Evaporative Emission Vent Solenoid Valve	L8T/LV1	Attached to the side of the EVAP canister, front of the fuel tank	—	Q13 Evaporative Emission Vent Solenoid Valve (L8T/LV1)
Q14	Exhaust Gas Recirculation Valve	LWN	In the engine compartment, on the top right of the engine	Left Front of the Engine Components (LWN)	Q14 Exhaust Gas Recirculation Valve (LWN)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
Q17A	Fuel Injector 1	—	On the left side of the intake manifold, at the #1 cylinder intake port	• Right Rear of Engine Components (LWN) • Top of the Engine Components (LV1)	• Q17A Fuel Injector 1 (L8T/LV1) • Q17A Fuel Injector 1 (LWN)
Q17B	Fuel Injector 2	—	On the right side of the intake manifold, at the #2 cylinder intake port	• Right Rear of Engine Components (LWN) • Top of the Engine Components (LV1)	• Q17B Fuel Injector 2 (L8T/LV1) • Q17B Fuel Injector 2 (LWN)
Q17C	Fuel Injector 3	—	On the left side of the intake manifold, at the #3 cylinder intake port	• Right Rear of Engine Components (LWN) • Top of the Engine Components (LV1)	• Q17C Fuel Injector 3 (L8T/LV1) • Q17C Fuel Injector 3 (LWN)
Q17D	Fuel Injector 4	—	On the right side of the intake manifold, at the #4 cylinder intake port	• Right Rear of Engine Components (LWN) • Top of the Engine Components (LV1)	• Q17D Fuel Injector 4 (L8T/LV1) • Q17D Fuel Injector 4 (LWN)
Q17E	Fuel Injector 5	L8T/LV1	On the left side of the intake manifold, at the #5 cylinder intake port	Top of the Engine Components (LV1)	Q17E Fuel Injector 5 (L8T/LV1)
Q17F	Fuel Injector 6	L8T/LV1	On the right side of the intake manifold, at the #6 cylinder intake port	Top of the Engine Components (LV1)	Q17F Fuel Injector 6 (L8T/LV1)
Q17G	Fuel Injector 7	L8T	On the left side of the intake manifold, at the #7 cylinder intake port	—	Q17G Fuel Injector 7 (L8T)
Q17H	Fuel Injector 8	L8T	On the right side of the intake manifold, at the #8 cylinder intake port	—	Q17H Fuel Injector 8 (L8T)
Q18A	Fuel Pressure Regulator 1	LWN	In the engine compartment, mounted on top of the fuel injection pump	Left Front of the Engine Components (LWN)	Q18A Fuel Pressure Regulator 1 (LWN)
Q18B	Fuel Pressure Regulator 2	LWN	In the engine compartment, mounted to the front of the left fuel rail	Left Front of the Engine Components (LWN)	Q18B Fuel Pressure Regulator 2 (LWN)
Q20	Intake Air Flow Valve	LWN	Attached to the center front of the intake manifold	—	Q20 Intake Air Flow Valve (LWN)
Q27A	Pressure Control Solenoid Valve 1	MYD	Internal to T12 Automatic Transmission Assembly	—	—
Q27B	Pressure Control Solenoid Valve 2	MYD	Internal to T12 Automatic Transmission Assembly	—	—
Q27C	Pressure Control Solenoid Valve 3	MYD	Internal to T12 Automatic Transmission Assembly	—	—
Q27D	Pressure Control Solenoid Valve 4	MYD	Internal to T12 Automatic Transmission Assembly	—	—
Q27E	Pressure Control Solenoid Valve 5	MYD	Internal to T12 Automatic Transmission Assembly	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
Q38	Throttle Body	L8T/LV1	Attached to the center front of the intake manifold	• Left Front of the Engine Components (LWN) • Right Side of the Engine Components (L8T) (2 of 2)	Q38 Throttle Body (L8T/LV1)
Q39A	Torque Converter Clutch Pressure Control Solenoid Valve	MYD	Internal to T12 Automatic Transmission Assembly	—	—
Q44	Engine Oil Pressure Control Solenoid Valve	L8T	In the engine compartment, at the front of the engine, behind the front cover	—	Q44 Engine Oil Pressure Control Solenoid Valve (L8T)
Q47	Exhaust Gas Recirculation Cooler Bypass Solenoid Valve	LWN	In the engine compartment, on the left side of the engine attached to the EGR valve	Right Front of Engine Components (LWN)	Q47 Exhaust Gas Recirculation Cooler Bypass Solenoid Valve (LWN)
Q61	Reductant Injector	LWN	Under the vehicle, attached to the exhaust pipe, near the rear of the catalytic converter	—	Q61 Reductant Injector (LWN)
Q67	Exhaust Aftertreatment Fuel Injector	LWN	In the engine compartment, on the right rear side of the engine	—	Q67 Exhaust Aftertreatment Fuel Injector (LWN)
Q77A	Transmission Control Solenoid Valve 1	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77A Transmission Control Solenoid Valve 1 (M5U/MQD)
Q77B	Transmission Control Solenoid Valve 2	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77B Transmission Control Solenoid Valve 2 (M5U/MQD)
Q77C	Transmission Control Solenoid Valve 3	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77C Transmission Control Solenoid Valve 3 (M5U/MQD)
Q77D	Transmission Control Solenoid Valve 4	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77D Transmission Control Solenoid Valve 4 (M5U/MQD)
Q77E	Transmission Control Solenoid Valve 5	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77E Transmission Control Solenoid Valve 5 (M5U/MQD)
Q77F	Transmission Control Solenoid Valve 6	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77F Transmission Control Solenoid Valve 6 (M5U/MQD)
Q77G	Transmission Control Solenoid Valve 7	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77G Transmission Control Solenoid Valve 7 (M5U/MQD)
Q77H	Transmission Control Solenoid Valve 8	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77H Transmission Control Solenoid Valve 8 (M5U/MQD)
Q77J	Transmission Control Solenoid Valve 9	M5U	Under the vehicle, internal to the Transmision Assembly	—	Q77J Transmission Control Solenoid Valve 9 (M5U/MQD)
Q85	Cooling Fan Clutch	LWN	In the engine compartment, attached to the cooling fan	• Front of Engine Compartment Components (1 of 2) • Left Side of Engine Components (LWN)	Q85 Cooling Fan Clutch

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
R3	Blower Motor Resistor	—	Right rear of the engine compartment, attached to the evaporator case	Engine Compartment Components (1 of 2)	R3 Blower Motor Resistor
R3B	Blower Motor Resistor - Auxiliary	C36/C69	In the left rear of the passenger compartment, attached to the auxiliary HVAC module	Left Rear Cargo Area Components (Passenger or Cargo)	R3B Blower Motor Resistor - Auxiliary
R6A	Terminating Resistor - High Speed Bus	—	In the engine compartment	—	R6A Terminating Resistor - High Speed Bus
R10	Cooling Fan Resistor	LWN	In the engine compartment	—	R10 Cooling Fan Resistor (LWN)
S2	Transmission Manual Shift Switch	—	Mounted on the shift lever, extending from the right side of the steering column	—	S2 Transmission Manual Shift Switch
S13A	Door Lock Switch - Rear Cargo	Passenger/Cargo with AU3	Attached to the right cargo door accessory mount plate	Rear Door Components (Passenger or Cargo)	S13A Door Lock Switch - Rear Cargo
S13D	Door Lock Switch - Driver	AU3	Attached to the left front door accessory mount plate	Driver Door Components	S13D Door Lock Switch - Driver
S13P	Door Lock Switch - Passenger	AU3	Attached to the right front door accessory mount plate	Front Passenger Door Components	S13P Door Lock Switch - Passenger
S16	Driver Information Center Switch	—	On the dash, just to the left of P16 Instrument Cluster	Instrument Panel Components (1 of 2)	S16 Driver Information Center Switch
S18	Exhaust Brake Switch	M5U	In the center of the instrument panel	—	S18 Exhaust Brake Switch (M5U)
S30	Headlamp Switch	—	At the left side of the instrument panel	Instrument Panel Components (1 of 2)	S30 Headlamp Switch
S33	Horn Switch	—	Inside the upper steering column, behind the inflatable restraint steering wheel module	Steering Column Components (1 of 2)	S33 Horn Switch
S34	HVAC Controls Switch Assembly	—	In the center of the instrument panel	Instrument Panel Components (1 of 2)	• S34 HVAC Controls Switch Assembly X1 • S34 HVAC Controls Switch Assembly X2 • S34 HVAC Controls Switch Assembly X3 • S34 HVAC Controls Switch Assembly X4
S34F	HVAC Controls Switch Assembly - Auxiliary Front	C36/C69	On the front of the overhead console	Headliner Components	• S34F HVAC Controls Switch Assembly - Auxiliary Front (With Rear HVAC Controls) • S34F HVAC Controls Switch Assembly - Auxiliary Front (Without Rear HVAC Controls)
S34R	HVAC Controls Switch Assembly - Auxiliary Rear	C36/C69 with Rear HVAC Controls	In the headliner, near the center of the vehicle	Headliner Components	S34R HVAC Controls Switch Assembly - Auxiliary Rear

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
S39	Ignition Switch	—	On the right side of the steering column	Steering Column Components (1 of 2)	S39 Ignition Switch
S40	Passenger Air Bag Disable Switch	C99	In the center of the instrument panel	Instrument Panel Components (1 of 2)	S40 Passenger Air Bag Disable Switch
S51	Telematics Button Assembly	UE1	In the center of the instrument panel, just below the radio	—	S51 Telematics Button Assembly
S52	Outside Rearview Mirror Switch	DEB/DE5	Attached to the left front door accessory mount plate	Driver Door Components	S52 Outside Rearview Mirror Switch
S64D	Seat Adjuster Switch - Driver	AG1	Attached to the front panel of the driver seat	Driver Seat Components	S64D Seat Adjuster Switch - Driver (AG1)
S64P	Seat Adjuster Switch - Passenger	AG2	Attached to the front panel of the front passenger seat	Passenger Seat Components	S64P Seat Adjuster Switch - Passenger (AG2)
S70L	Steering Wheel Controls Switch - Left	K34	On the left steering wheel spoke	Instrument Panel Components (1 of 2)	S70L Steering Wheel Controls Switch - Left (K34)
S70R	Steering Wheel Controls Switch - Right	W1Y	On the right steering wheel spoke	Instrument Panel Components (1 of 2)	S70R Steering Wheel Controls Switch - Right (W1Y)
S74	Tow/Haul Mode Switch	MYD	In the center of the instrument panel	Instrument Panel Components (1 of 2)	S74 Tow/Haul Mode Switch
S75	Traction Control Switch	—	In the center of the instrument panel	Instrument Panel Components (1 of 2)	S75 Traction Control Switch
S78	Turn Signal/Multifunction Switch	—	On the left side of the steering column	• Instrument Panel Components (1 of 2) • Steering Column Components (1 of 2)	• S78 Turn Signal/Multifunction Switch X1 • S78 Turn Signal/Multifunction Switch X2 • S78 Turn Signal/Multifunction Switch X3
S79D	Window Switch - Driver	A31	Attached to the left front door accessory mount plate	Driver Door Components	S79D Window Switch - Driver
S79P	Window Switch - Passenger	A31	Attached to the right front door accessory mount plate	Front Passenger Door Components	S79P Window Switch - Passenger
S85	Auxiliary Blower Motor Switch	C36/C69	In the center of the instrument panel	Instrument Panel Components (1 of 2)	S85 Auxiliary Blower Motor Switch (C36)
S155	Lane Departure Warning Switch	UFL	Near the center of the instrument panel, below the radio	—	S155 Lane Departure Warning Switch
T1	Accessory DC/AC Power Inverter Module	KI4	Attached to the Instrument Panel Harness	—	T1 Accessory DC/AC Power Inverter Module
T4G	Cellular Phone, Navigation, and Digital Radio Antenna	U2K/UBS	Mounted towards the left front of the roof	—	—
T4M	Radio Antenna	—	Mounted on top of the right front fender, adjacent to the hood	Right Rear of the Engine Compartment Components	T4M Radio Antenna
T4S	Wireless Communication Antenna - Bluetooth	UE1	Internal to K73 Telematics Communication Interface Control Module	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
T8A	Ignition Coil 1	—	On the left rocker cover center at cylinder 1	• Left Side of the Engine Components (L8T) • Upper Left Side of the Engine Components (LV1)	T8A Ignition Coil 1
T8B	Ignition Coil 2	—	On the right rocker cover center at cylinder 2	Right Side of the Engine Components (L8T) (2 of 2)	T8B Ignition Coil 2
T8C	Ignition Coil 3	—	On the left rocker cover center at cylinder 3	• Left Side of the Engine Components (L8T) • Upper Left Side of the Engine Components (LV1)	T8C Ignition Coil 3
T8D	Ignition Coil 4	—	On the right rocker cover center at cylinder 4	Right Side of the Engine Components (L8T) (2 of 2)	T8D Ignition Coil 4
T8E	Ignition Coil 5	L8T/LV1	On the left rocker cover center at cylinder 5	• Left Side of the Engine Components (L8T) • Upper Left Side of the Engine Components (LV1)	T8E Ignition Coil 5
T8F	Ignition Coil 6	L8T/LV1	On the right rocker cover center at cylinder 6	Right Side of the Engine Components (L8T) (2 of 2)	T8F Ignition Coil 6
T8G	Ignition Coil 7	L8T	On the left rocker cover rear at cylinder 7	Left Side of the Engine Components (L8T)	T8G Ignition Coil 7
T8H	Ignition Coil 8	L8T	On the right rocker cover rear at cylinder 8	Right Side of the Engine Components (L8T) (2 of 2)	T8H Ignition Coil 8
T12	Automatic Transmission Assembly	—	Under the vehicle attached to the rear of the engine	—	T12 Automatic Transmission Assembly
W8	Blunt Cut - Trailer Provision	UY7	Behind the instrument panel, near the steering column	—	—
W12	Blunt Cut - Emergency Vehicle Provision	YF1	Near the instrument panel	—	—
W22	Blunt Cut - Rear Speaker Provision	CUTAWAY with YF1	Near the instrument panel	—	—
W25	Blunt Cut - Configurable Provision	9L7	Near the instrument panel	—	—
X50A	Fuse Block - Underhood	—	In the engine compartment, attached to the left front fender	• Engine Compartment Components (1 of 2) • Engine Compartment Components (2 of 2) • Engine Harness Routing - Engine Compartment (LV1) (1 of 2)	Electrical Center Identification Views
X50B	Fuse Block - Underhood Auxiliary	—	In the engine compartment	—	Electrical Center Identification Views

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X52A	Fuse Block - Passenger Compartment	—	Below the driver seat	Body Harness Routing - Left Front Passenger Compartment	Electrical Center Identification Views
X53A	Fuse Block - Rear Body	PRP	Within the cargo area	—	Electrical Center Identification Views
X54D	Fuse Block - Fuel Heater	LWN	Within the engine compartment	—	Electrical Center Identification Views
X55AF	Fuse Holder - Engine Control Module	LWN	Within the engine compartment	Front of Engine Compartment Components (2 of 2)	Electrical Center Identification Views
X55AS	Fuse Holder - Rear Body Fuse Block	LWN	Within the engine compartment	Front of Engine Compartment Components (2 of 2)	Electrical Center Identification Views
X55AT	Fuse Holder 1 - Auxiliary Battery	LWN	Within the engine compartment	—	Electrical Center Identification Views
X55U	Fuse Holder - Starter	—	In the engine compartment, passenger side, near the battery	Engine Compartment Components (2 of 2)	Electrical Center Identification Views
X60A	Junction Block - Underhood	LWN/TP3	In the engine compartment, in-between M64 Starter Motor and X50A Fuse Block - Underhood	—	Electrical Center Identification Views
X80A	Accessory Power Receptacle - Center Console 1	—	In the center of the instrument panel	Instrument Panel Components (1 of 2)	X80A Accessory Power Receptacle - Center Console 1
X80B	Accessory Power Receptacle - Center Console 2	—	In the right center of the instrument panel	Instrument Panel Components (1 of 2)	X80B Accessory Power Receptacle - Center Console 2
X81	Accessory Power Receptacle - 110V AC	KI4	Within the passenger compartment	—	• X81 Accessory Power Receptacle - 110V AC X1 • X81 Accessory Power Receptacle - 110V AC X2
X84	Data Link Connector	—	Left lower side of the instrument panel, near the park brake pedal assembly	Instrument Panel Components (1 of 2)	X84 Data Link Connector
X85	Steering Wheel Air Bag Coil	—	Inside the upper steering column	—	• X85 Steering Wheel Air Bag Coil X1 • X85 Steering Wheel Air Bag Coil X2 • X85 Steering Wheel Air Bag Coil X3
X87RB	Sliding Door Jamb Contact Plate - Right Body	AU3 with E24/YA2	Attached to the right B-pillar	• Right Side Hinged Door Components (E24) • Right Sliding Door Components (YA2)	• X87RB Sliding Door Jamb Contact Plate - Right Body (Body) • X87RB Sliding Door Jamb Contact Plate - Right Body (Sliding Door)
X88	Trailer Connector	UY7	Below the rear bumper, near the center	—	• X88 Trailer Connector (NE7) • X88 Trailer Connector (-NE7)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X92	USB Receptacle	USR	Slightly below and to the right of A11 Radio	—	X92 USB Receptacle
X100	Instrument Panel Wiring Harness to Engine Wiring Harness	—	Left rear of the engine compartment near the underhood fuse block and the horn	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Front (L8T) • Instrument Panel Harness Routing - Engine Compartment	X100 Instrument Panel Wiring Harness to Engine Wiring Harness
X101	Engine Wiring Harness to Chassis Wiring Harness	L8T/LV1	Left rear of the engine compartment behind the underhood fuse block	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Front (L8T)	X101 Engine Wiring Harness to Chassis Wiring Harness
X102	Chassis Wiring Harness to Fuel Tank Wiring Harness	L8T/LV1	Under the vehicle, near the fuel tank	—	X102 Chassis Wiring Harness to Fuel Tank Wiring Harness
X103	Engine Wiring Harness to Starter Jumper Wiring Harness	—	In the engine compartment, right rear of engine block, near the starter	Engine Harness Routing - Right (L8T)	X103 Engine Wiring Harness to Starter Jumper Wiring Harness
X104	Instrument Panel Wiring Harness to Air Bag Jumper Wiring Harness	—	Instrument Panel wiring harness to Air Bag Jumper wiring harness, bottom left side of the radiator support	Instrument Panel Harness Routing - Engine Compartment	X104 Instrument Panel Wiring Harness to Air Bag Jumper Wiring Harness
X108	Battery Positive Cable Wiring Harness to Engine Wiring Harness	LWN	Battery cable wiring harness to the engine wiring harness, near the front of the engine compartment	Battery Positive Cable Harness Routing (LWN)	X108 Battery Positive Cable Wiring Harness to Engine Wiring Harness
X109	Engine Wiring Harness to Underhood Lamp Wiring Harness	TR9	Engine wiring harness to Underhood Lamp wiring harness, left rear of the engine compartment	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Front (L8T)	X109 Engine Wiring Harness to Underhood Lamp Wiring Harness
X111	Engine Wiring Harness to Diesel Glow Plug Wiring Harness	LWN	In the engine compartment, on the left side of the engine toward the top	—	X111 Engine Wiring Harness to Diesel Glow Plug Wiring Harness
X112	Engine Wiring Harness to Intake Manifold Pressure and Air Temperature Sensor Jumper Wiring Harness	LWN	Fuel rail jumper wiring harness to the engine wiring harness, in the engine compartment, near the upper rear corner of the left valve cover	—	X112 Engine Wiring Harness to Intake Manifold Pressure and Air Temperature Sensor Jumper Wiring Harness
X116	Engine Wiring Harness to Chassis Wiring Harness	LWN	In the engine compartment	—	X116 Engine Wiring Harness to Chassis Wiring Harness

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X130	Engine Wiring Harness to Camshaft Position Sensor Jumper Wiring Harness	L8T/LV1	In the engine compartment, on the left rear side of engine block	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Front (L8T) • Engine Harness Routing - Front (LV1)	X130 Engine Wiring Harness to Camshaft Position Sensor Jumper Wiring Harness
X135	Engine Jumper Wiring Harness to Oil Pump Flow Control Solenoid Valve Wire Wiring Harness	L8T	In the engine compartment, on the left rear side of engine block	Engine Harness Routing - Front (LV1)	X135 Engine Jumper Wiring Harness to Oil Pump Flow Control Solenoid Valve Wire Wiring Harness (L8T)
X141	Instrument Panel Wiring Harness to Brake Fluid Level Indicator Wiring Harness	UJ1	Instrument panel wiring harness to the brake fluid alarm switch jumper wiring harness, left rear of the engine compartment near the cowl	• Brake Booster Fluid Alarm Switches (UJ1) • Instrument Panel Harness Routing - Engine Compartment	X141 Instrument Panel Wiring Harness to Brake Fluid Level Indicator Wiring Harness
X142	Engine Wiring Harness to Cooling Fan Clutch Jumper Wiring Harness	LWN	Engine chassis wiring harness to the fan jumper wiring harness, near the front of the engine	Front of Engine Compartment Components (2 of 2)	X142 Engine Wiring Harness to Cooling Fan Clutch Jumper Wiring Harness
X150	Instrument Panel Wiring Harness to Forward Lamp Wiring Harness	—	Instrument panel wiring harness to the forward lamp wiring harness, near the upper radiator hose at the radiator entry point	• Forward Lamp Harness Routing • Instrument Panel Harness Routing - Engine Compartment	X150 Instrument Panel Wiring Harness to Forward Lamp Wiring Harness
X155	Engine Wiring Harness to Engine Coolant Temperature Sensor Wiring Harness	L8T/LV1	Engine wiring harness to Engine Oil Pressure Sensor Jumper wiring harness, in the engine compartment, left front of the engine, near the power steering pump	Engine Harness Routing - Front (L8T)	X155 Engine Wiring Harness to Engine Coolant Temperature Sensor Wiring Harness (L8T)
X160	Engine Wiring Harness to Fuel Injector Wiring Harness	L8T/LV1	In the engine compartment, rear of the engine near the top center	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Rear (L8T) • Fuel Injector Harness Routing (LV1)	• X160 Engine Wiring Harness to Fuel Injector Wiring Harness (L8T) • X160 Engine Wiring Harness to Fuel Injector Wiring Harness (LV1)
X161	Engine Wiring Harness to Fuel Injector Wiring Harness	L8T/LV1	In the engine compartment, rear of the engine near the top right	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Rear (L8T) • Fuel Injector Harness Routing (LV1)	• X161 Engine Wiring Harness to Fuel Injector Wiring Harness (L8T) • X161 Engine Wiring Harness to Fuel Injector Wiring Harness (LV1)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X175	Engine Wiring Harness to Automatic Transmission Wiring Harness	M5U	Engine wiring harness to the transmission jumper wiring harness	—	X175 Engine Wiring Harness to Automatic Transmission Wiring Harness (M5U/MQD)
X176	Automatic Transmission Wiring Harness to Automatic Transmission Control Wiring Harness	M5U/MQD	Internal to the transmission	—	X176 Automatic Transmission Wiring Harness to Automatic Transmission Control Wiring Harness (M5U/MQD)
X178	Automatic Transmission Wiring Harness to Automatic Transmission Output Speed Sensor Wiring Harness	M5U/MQD	Transmission wiring harness to the transmission speed sensor wiring harness	—	X178 Automatic Transmission Wiring Harness to Automatic Transmission Output Speed Sensor Wiring Harness (M5U/MQD)
X185	Instrument Panel Wiring Harness to Chassis Wiring Harness	—	In the engine compartment, near the X50A fuse block - underhood	—	X185 Instrument Panel Wiring Harness to Chassis Wiring Harness
X190	Accessory Wiring Harness to Accessory Power Fuse Block Rear Wiring Harness Extension Harness	—	In the engine compartment	—	X190 Accessory Wiring Harness to Accessory Power Fuse Block Rear Wiring Harness Extension Harness
X200	Steering Wheel Wiring Harness to Instrument Panel Wiring Harness	—	Steering column wiring harness to the instrument panel wiring harness, at the base of the steering column	• Instrument Panel Harness Routing - Dash Area (1 of 2) • Steering Column Harness Routing	X200 Steering Wheel Wiring Harness to Instrument Panel Wiring Harness
X202	Instrument Panel Wiring Harness to Engine Wiring Harness	—	Instrument panel wiring harness to engine wiring harness, about 8.8 inches (225 mm) from I/P underhood break out after pass through grommet	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Front (L8T)	X202 Instrument Panel Wiring Harness to Engine Wiring Harness
X204	Body Wiring Harness to Roof Console Wiring Harness	—	Body wiring harness to headliner wiring harness,	• Body Harness Routing - Right Front of Passenger Compartment (1 of 2) • Body Harness Routing - Right Front of Passenger Compartment (2 of 2)	X204 Body Wiring Harness to Roof Console Wiring Harness
X205	Roof Console Wiring Harness to Body Wiring Harness	—	Front headliner wiring harness to the body wiring harness, behind the A-pillar	• Body Harness Routing - Right Front of Passenger Compartment (1 of 2) • Body Harness Routing - Right Front of Passenger Compartment (2 of 2) • Body Harness Routing - Roof Area	X205 Roof Console Wiring Harness to Body Wiring Harness

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X206	Instrument Panel Wiring Harness to Instrument Panel Wiring Harness	—	Instrument Panel wiring harness to Instrument Panel wiring harness, left side of the instrument panel near the headlamp switch	—	X206 Instrument Panel Wiring Harness to Instrument Panel Wiring Harness
X220	Instrument Panel Wiring Harness to Park Brake Switch Jumper Wiring Harness	—	Instrument panel wiring harness to the parking brake jumper wiring harness, left side of the instrument panel, center of the parking brake pedal assembly	—	X220 Instrument Panel Wiring Harness to Park Brake Switch Jumper Wiring Harness
X221	Instrument Panel Wiring Harness to Antenna Wiring Harness	—	Instrument Panel Wiring Harness to Antenna Wiring Harness, behind the passenger kick panel	—	X221 Instrument Panel Wiring Harness to Antenna Wiring Harness
X225	Accelerator Control Wiring Harness to Instrument Panel Wiring Harness	—	Accelerator Pedal Position (APP) Jumper wiring harness to Instrument Panel wiring harness, located between Accelerator Pedal Position (APP) sensor and Instrument Panel wiring harness	—	X225 Accelerator Control Wiring Harness to Instrument Panel Wiring Harness
X289	Side Access Panel Wiring Harness to Instrument Panel Wiring Harness	PRP	Inside the vehicle, towards the left front	—	X289 Side Access Panel Wiring Harness to Instrument Panel Wiring Harness
X290	Instrument Panel Wiring Harness to Side Access Panel Wiring Harness	PRP	Inside the vehicle, towards the left front	—	X290 Instrument Panel Wiring Harness to Side Access Panel Wiring Harness
X291	Accessory Power Fuse Block Rear Wiring Harness Extension Harness to Accessory Power Fuse Block Rear Wiring Harness Extension Harness	—	In the engine compartment	—	X291 Accessory Power Fuse Block Rear Wiring Harness Extension Harness to Accessory Power Fuse Block Rear Wiring Harness Extension Harness
X306	Body Wiring Harness to Passenger Seat Wiring Harness	—	Body wiring harness to the front passenger seat wiring harness, right side of the passenger compartment below the passenger seat	• Body Harness Routing - Right Front of Passenger Compartment (1 of 2) • Body Harness Routing - Right Front of Passenger Compartment (2 of 2) • Driver Seat Harness Routing and Front Passenger Seat Harness Routing • Passenger Seat Components	X306 Body Wiring Harness to Passenger Seat Wiring Harness

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X307	Body Wiring Harness to Driver Seat Wiring Harness	—	Body wiring harness to the driver seat wiring harness, left side of the passenger compartment below the driver seat	• Body Harness Routing - Left Front Passenger Compartment • Driver Seat Components • Driver Seat Harness Routing and Front Passenger Seat Harness Routing	X307 Body Wiring Harness to Driver Seat Wiring Harness
X318	Instrument Panel Wiring Harness to Body Wiring Harness	—	Instrument panel wiring harness to the body wiring harness, behind the left kick panel	• Body Harness Routing - Left Front Passenger Compartment • Instrument Panel Harness Routing - Dash Area (1 of 2)	X318 Instrument Panel Wiring Harness to Body Wiring Harness
X319	Auxiliary Heater Front Wiring Harness to Body Wiring Harness	ENC/C69/C36	Rear heater switch wiring harness to the body wiring harness, behind the left kick panel	Body Harness Routing - Left Front Passenger Compartment	X319 Auxiliary Heater Front Wiring Harness to Body Wiring Harness
X320	Upfitter Jumper Wiring Harness to Body Wiring Harness	YF2	Upfitter wiring harness to the body wiring harness, left side of the passenger compartment lower left C-pillar	—	X320 Upfitter Jumper Wiring Harness to Body Wiring Harness
X323	Airbag Wiring Harness to Body Wiring Harness	ASF	At the base of the left C-pillar	Body Harness Routing - Left Front Passenger Compartment	X323 Airbag Wiring Harness to Body Wiring Harness
X324	Airbag Wiring Harness to Body Wiring Harness	ASF	At the base of the right C-pillar	Body Harness Routing - Right C-Pillar	X324 Airbag Wiring Harness to Body Wiring Harness
X329	Instrument Panel Wiring Harness to Body Wiring Harness	UVC	Instrument panel wiring harness to the body wiring harness, in the passenger compartment under the driver seat	Body Harness Routing - Left Front Passenger Compartment	X329 Instrument Panel Wiring Harness to Body Wiring Harness
X330	Instrument Panel Wiring Harness to Body Wiring Harness	—	Instrument panel wiring harness to the body wiring harness, under the driver seat	• Body Harness Routing - Left Front Passenger Compartment • Instrument Panel Harness Routing - Dash Area (1 of 2)	X330 Instrument Panel Wiring Harness to Body Wiring Harness
X331	Instrument Panel Wiring Harness to Body Wiring Harness	—	Instrument panel wiring harness to the body wiring harness, under the driver seat	• Body Harness Routing - Left Front Passenger Compartment • Instrument Panel Harness Routing - Dash Area (1 of 2)	X331 Instrument Panel Wiring Harness to Body Wiring Harness
X390	Chassis Wiring Harness to Fuel Operated Heater Jumper Wiring Harness	-K08	Under the vehicle, along the left inner frame rail, near the fuel pump assembly	—	X390 Chassis Wiring Harness to Fuel Operated Heater Jumper Wiring Harness (-K08)

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X400	Rear Door Door Wiring Harness to Body Wiring Harness	Passenger/Cargo	Right cargo door wiring harness to the body wiring harness, right rear of the passenger compartment center of the right D-pillar	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2) • Rear Cargo Doors Harness Routing (Passenger or Cargo)	X400 Rear Door Door Wiring Harness to Body Wiring Harness
X403	Rear Door Door Wiring Harness to Body Wiring Harness	UVC	Rear cargo door wiring harness to body wiring harness,	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	• X403 Rear Door Door Wiring Harness to Body Wiring Harness (-Cutaway) • X403 Rearview Camera Wiring Harness to Body Wiring Harness (Cutaway)
X405	Chassis Wiring Harness to Chassis Wiring Harness	Cutaway	Cutaway rear lighting connector to the chassis wiring harness, left rear frame rail	—	X405 Chassis Wiring Harness to Chassis Wiring Harness
X407	Auxiliary Heater and Air Conditioning Wiring Harness to Body Wiring Harness	C36/C69	Rear HVAC wiring harness to the body wiring harness, left rear of the passenger compartment upper back side of the auxiliary HVAC module at the D-pillar	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2)	X407 Auxiliary Heater and Air Conditioning Wiring Harness to Body Wiring Harness
X408	Rear Object Alarm Sensor Wiring Harness to Chassis Wiring Harness	UD7/UFT	Rear bumper wiring harness to chassis wiring harness,	Rear Bumper Harness Routing	X408 Rear Object Alarm Sensor Wiring Harness to Chassis Wiring Harness
X409	Auxiliary Heater and Air Conditioning Wiring Harness to Body Wiring Harness	C36/C69	Rear HVAC wiring harness to body wiring harness, left rear of the passenger compartment upper back side of the auxiliary HVAC module	Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo)	X409 Auxiliary Heater and Air Conditioning Wiring Harness to Body Wiring Harness
X410	Tail Lamp Assembly - Left to Body Wiring Harness	Passenger/Cargo	Left Tail Lamp Assembly wiring harness to Body wiring harness, left rear of the passenger compartment at the D-pillar	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2)	X410 Tail Lamp Assembly - Left to Body Wiring Harness

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X411	Rear Door Door Wiring Harness to Body Wiring Harness	Passenger/Cargo	Left cargo door wiring harness to the body wiring harness, left rear of the passenger compartment center of the left D-pillar	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Rear Cargo Doors Harness Routing (Passenger or Cargo)	X411 Rear Door Door Wiring Harness to Body Wiring Harness
X412	Rear Door Door Wiring Harness to Body Wiring Harness	Passenger/Cargo	Right cargo door wiring harness to the body wiring harness, right rear of the passenger compartment center of the right D-pillar	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2) • Rear Cargo Doors Harness Routing (Passenger or Cargo)	X412 Rear Door Door Wiring Harness to Body Wiring Harness
X415	Radio Rear Speaker Wiring Harness to Body Wiring Harness	Passenger/Cargo	Rear overhead speakers jumper wiring harness to the body wiring harness, rear of the passenger compartment center of the rear roof rail	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	X415 Radio Rear Speaker Wiring Harness to Body Wiring Harness
X419	Center High Mounted Stop Lamp Jumper Wiring Harness to Body Wiring Harness	Passenger/Cargo	CHMSL wiring harness to the body wiring harness, rear of the passenger compartment center of the rear roof rail	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2)	X419 Center High Mounted Stop Lamp Jumper Wiring Harness to Body Wiring Harness
X420	Tail Lamp Assembly - Right to Body Wiring Harness	Passenger/Cargo	Right Tail Lamp Assembly wiring harness to Body wiring harness, right rear of the passenger compartment at the D-pillar	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2) • Body Harness Routing - Roof Area	X420 Tail Lamp Assembly - Right to Body Wiring Harness

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
X421	Roof Console Wiring Harness to Body Wiring Harness	—	Body wiring harness to rear headliner wiring harness	• Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Roof Area	X421 Roof Console Wiring Harness to Body Wiring Harness
X460	Chassis Wiring Harness to Chassis Wiring Harness	Cutaway with UY7 and NE7	Trailer Provision to Chassis wiring harness, in rear near Trailer wiring harness	—	X460 Chassis Wiring Harness to Chassis Wiring Harness
X500	Front Side Door Door Wiring Harness - Driver to Body Wiring Harness	—	Driver door wiring harness to the body wiring harness, behind the left kick panel	Body Harness Routing - Left Front Passenger Compartment	X500 Front Side Door Door Wiring Harness - Driver to Body Wiring Harness
X501	Airbag Wiring Harness to Front Side Door Door Wiring Harness - Driver	ASF	Driver side impact sensor wiring harness to the driver door wiring harness, in the driver door behind the trim panel	—	X501 Airbag Wiring Harness to Front Side Door Door Wiring Harness - Driver
X600	Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness	—	Passenger door wiring harness to the body wiring harness, behind the right kick panel	• Body Harness Routing - Right Front of Passenger Compartment (1 of 2) • Body Harness Routing - Right Front of Passenger Compartment (2 of 2)	X600 Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness
X601	Side Impact Sensor - Right Front Jumper Wiring Harness to Front Side Door Door Wiring Harness - Passenger	ASF	Passenger side impact sensor wiring harness to the passenger door wiring harness, in the passenger door behind the trim panel	—	X601 Side Impact Sensor - Right Front Jumper Wiring Harness to Front Side Door Door Wiring Harness - Passenger
X901	Rear Window Defogger Wiring Harness to Rear Door Door Wiring Harness	C49	Rear window defogger jumper wiring harness to the left cargo door wiring harness, in the left cargo door	Rear Cargo Doors Harness Routing (Passenger or Cargo)	X901 Rear Window Defogger Wiring Harness to Rear Door Door Wiring Harness
X902	Rear Window Defogger Wiring Harness to Rear Door Door Wiring Harness	C49	Rear window defogger jumper wiring harness to the right cargo door wiring harness, in the right cargo door	Rear Cargo Doors Harness Routing (Passenger or Cargo)	X902 Rear Window Defogger Wiring Harness to Rear Door Door Wiring Harness
G100	Forward Lamp Wiring Harness	—	Left front of the engine compartment, attached to the front of the left fender	G100 and G101	—
G101	Forward Lamp Wiring Harness	—	Right front of the engine compartment, attached near the front of the right fender	G100 and G101	—
G102	Engine Wiring Harness	—	Rear of the engine compartment, left rear of the engine on the left cylinder head	• G102 (LV1) • G102, G103, and G108 (L8T)	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
G103	Engine Wiring Harness	—	Rear of the engine compartment, left rear of the engine on the left cylinder head	G102, G103, and G108 (L8T)	—
G104	Negative Battery Cable	—	Mounted on the engine, extending towards the battery	G104 (L8T)	—
G105	Negative Battery Cable	—	Front of the engine compartment, right front of the inner frame rail	G105 and G106 (L8T)	—
G106	Negative Battery Cable	—	Front of the engine compartment, right front fender	G105 and G106 (L8T)	—
G107	Engine Wiring Harness	LV1	Rear of the engine compartment, right rear of the engine on the right cylinder head	G107 and G108 (LV1)	—
G108	Engine Wiring Harness	L8T/LV1	Rear of the engine compartment, left rear of the engine on the left cylinder head	• G102, G103, and G108 (L8T) • G107 and G108 (LV1)	—
G300	Chassis Wiring Harness	—	Left side outer frame, rear of the front tire, near the body mount	G300, G400, G404 and G405	—
G301	Instrument Panel	—	Left front of the passenger compartment, behind the kick panel next to G302	—	—
G302	Instrument Panel	—	Left front of the passenger compartment, behind the kick panel next to G301	G302 and G347	—
G304	Instrument Panel	—	Right front of the passenger compartment, behind the kick panel	G304	—
G305	Auxiliary Battery Negative Cable	LWN/TP3	Left center outer frame rail, near the auxiliary battery	• Frame and Underbody Components (2 of 2) • G305	—
G347	Body Wiring Harness	—	Left side of the passenger compartment, lower left B-pillar part of JX347	G302 and G347	—
G348	Body Wiring Harness	—	Right side of the passenger compartment, lower right B-pillar part of JX348	—	—
G400	Chassis Wiring Harness	LWN	Left rear inner side frame rail	G300, G400, G404 and G405	—
G401	Body Wiring Harness	Passenger/Cargo	Right rear of the passenger compartment, upper right D-pillar	G401 and G402 (Passenger or Cargo)	—
G402	Body Wiring Harness	Passenger/Cargo	Left rear of the passenger compartment, center left D-pillar	G401 and G402 (Passenger or Cargo)	—
G403	Side Access Panel Wiring Harness	PRP	Left rear of the passenger compartment, center left D-pillar	—	—
G404	Chassis Wiring Harness	—	In vehicle underbody, near center, on left frame rail	G300, G400, G404 and G405	—
G405	Chassis Wiring Harness	LWN	In vehicle underbody, near center, on left frame rail	G300, G400, G404 and G405	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J100	Forward Lamp Wiring Harness	—	At the left front of the engine compartment, just behind the left front headlamp assembly	—	—
J101	Engine Wiring Harness	—	In the engine wiring harness, on the right side of the engine, approximately 5 cm (2 in) from the MAP sensor breakout	• *Engine Harness Routing - Engine Compartment (LV1) (1 of 2)* • *Engine Harness Routing - Front (L8T)*	—
J102	Engine Wiring Harness	—	In the engine wiring harness, on the right side of the engine, approximately 6 cm (2 in) from the MAP sensor breakout	• *Engine Harness Routing - Engine Compartment (LV1) (1 of 2)* • *Engine Harness Routing - Front (L8T)*	—
J105	Fuse Block Jumper Wiring Harness	9L7	In the fuse block jumper wiring harness, between KR81 Auxiliary Battery Relay 1 and X50B Fuse Block – Underhood Auxiliary	—	—
J106	Fuse Block Jumper Wiring Harness	9L7	In the fuse block jumper wiring harness	—	—
J107	Engine Wiring Harness	L8T/LV1	In the engine wiring harness, approximately 11.5 cm (4.53 in) from the horn assembly breakout	*Engine Harness Routing - Engine Compartment (LV1) (2 of 2)*	—
J108	Engine Wiring Harness	L8T	In the engine wiring harness, approximately 10.5 cm (4.0 in) from the engine control module breakout	*Engine Harness Routing - Rear (L8T)*	—
J110	Forward Lamp Wiring Harness	—	In the forward lamp wiring harness, Left front of the vehicle, approximately 12 cm (5 in) from the left headlamp connector breakout	*Forward Lamp Harness Routing*	—
J111	Engine Wiring Harness	L8T	In the engine wiring harness, approximately 5.0 cm (2.0 in) from the brake fluid level switch breakout	*Engine Harness Routing - Front (L8T)*	—
J112	Engine Wiring Harness	L8T/LV1	In the engine wiring harness, approximately 33.5 cm (13.2 in) from the multifunction intake air sensor breakout	*Engine Harness Routing - Engine Compartment (LV1) (2 of 2)*	—
J115	Engine Wiring Harness	—	In the engine wiring harness, in the right front of the engine compartment, approximately 15 cm (6 in) from the X101 breakout	• *Engine Harness Routing - Engine Compartment (LV1) (2 of 2)* • *Engine Harness Routing - Front (L8T)*	—
J116	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 25.5 cm (10.04 in) from X202	*Engine Harness Routing - Front (LWN)*	—
J117	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 21.5 cm (8.5 in) from X202	*Engine Harness Routing - Front (LWN)*	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J119	Chassis Wiring Harness	K08	In the chassis wiring harness, near the left front inner frame rail, approximately 15 cm (6 in) from the coolant heater breakout	—	—
J121	Forward Lamp Wiring Harness	—	In the forward lamp wiring harness, near the front center of the vehicle, approximately 48 cm (19 in) from the left headlamp breakout	*Forward Lamp Harness Routing*	—
J122	Forward Lamp Wiring Harness	—	In the forward lamp wiring harness, near the left front of the vehicle, approximately 12 cm (5 in) from the underhood fuse block X4 breakout	*Forward Lamp Harness Routing*	—
J123	Engine Wiring Harness	L8T	In the engine wiring harness, near the left front side of the vehicle, approximately 16 cm (6 in) from the underhood fuse block X1 breakout	*Engine Harness Routing - Front (L8T)*	—
J125	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 24.5 cm (9.6 in) from the cooling fan resistor breakout	—	—
J126	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 25.5 cm (10 in) from the horn assembly breakout	—	—
J127	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 12.0 cm (4.7 in) from the brake fluid level switch breakout	—	—
J128	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 14.5 cm (5.7 in) from the fuse block – fuel heater breakout	—	—
J130	Engine Wiring Harness	L8T/LV1	In the engine wiring harness, approximately 12.5 cm (4.9 in) from the knock sensor 1 breakout	*Engine Harness Routing - Front (L8T)*	—
J131	Engine Wiring Harness	L8T/LV1	In the engine wiring harness, approximately 19.5 cm (7.7 in) from the knock sensor 1 breakout	*Engine Harness Routing - Front (L8T)*	—
J132	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 35.5 cm (14 in) from nitrogen oxides sensor 1	*Engine Harness Routing - Front (LWN)*	—
J133	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 31.5 cm (12.4 in) from nitrogen oxides sensor 1	*Engine Harness Routing - Front (LWN)*	—
J135	Engine Wiring Harness	LWN	In the engine wiring harness, approximately 24.5 cm (9.6 in) from the fuse block – fuel heater breakout	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J143	Engine Wiring Harness	L8T/LV1	Adjacent to B52C Heated Oxygen Sensor - Bank 1 Sensor 1 and B52E Heated Oxygen Sensor - Bank 2 Sensor 1	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Rear (L8T)	—
J144	Engine Wiring Harness	L8T/LV1	Adjacent to B52D Heated Oxygen Sensor - Bank 1 Sensor 2 and B52F Heated Oxygen Sensor - Bank 2 Sensor 2	• Engine Harness Routing - Engine Compartment (LV1) (1 of 2) • Engine Harness Routing - Rear (L8T)	—
J170	Engine Wiring Harness	LV1	In the engine wiring harness, approximately 24.5 cm (9.6 in) from ignition coil 5	Engine Harness Routing - Engine Compartment (LV1) (1 of 2)	—
J171	Engine Wiring Harness	LV1	In the engine wiring harness, approximately 26 cm (10.2 in) from ignition coil 6	Engine Harness Routing - Engine Compartment (LV1) (1 of 2)	—
J175	Transmission Internal Wiring Harness	M5U	Within the automatic transmission assembly	—	—
J176	Transmission Internal Wiring Harness	M5U	Within the automatic transmission assembly	—	—
J177	Transmission Internal Wiring Harness	M5U	Within the automatic transmission assembly	—	—
J181	Ignition Coil Jumper Wiring Harness	L8T	In the ignition coil jumper wiring harness for bank 1, approximately 5 cm (2.0 in) from the X126 breakout	Engine Harness Routing - Rear (L8T)	—
J182	Left Ignition Coil Wiring Harness	L8T/LV1	In the odd ignition/coil module jumper wiring harness, top left of the engine	• Engine Harness Routing - Engine Compartment (LV1) (2 of 2) • Engine Harness Routing - Front (L8T)	—
J183	Right Ignition Coil Wiring Harness	L8T	In the even ignition/coil module jumper wiring harness, top right of the engine	Engine Harness Routing - Rear (L8T)	—
J184	Left Ignition Coil Wiring Harness	LV1	In the odd ignition/coil module jumper wiring harness, top left of the engine	Engine Harness Routing - Engine Compartment (LV1) (2 of 2)	—
J185	Right Ignition Coil Wiring Harness	LV1	In the even ignition/coil module jumper wiring harness, top right of the engine	Engine Harness Routing - Engine Compartment (LV1) (2 of 2)	—
J188	Right Ignition Coil Wiring Harness	L8T/LV1	In the even ignition/coil module jumper wiring harness, top right of the engine	• Engine Harness Routing - Engine Compartment (LV1) (2 of 2) • Engine Harness Routing - Rear (L8T)	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J201	Instrument Panel	UFL	In the instrument panel harness, approximately 2 cm (0.79 in) from the park brake switch breakout	—	—
J202	Steering Column Wiring Harness	—	In the steering column wiring harness, approximately 25 cm (9 in) from the X200 connector	—	—
J203	Steering Column Wiring Harness	—	In the steering column wiring harness, approximately 27 cm (10.5 in) from the X200 connector	—	—
J205	Steering Column Wiring Harness	—	In the steering column wiring harness, approximately 30 cm (12 in) from the X200 connector	—	—
J207	Instrument Panel	—	In the instrument panel harness, center of the instrument panel, approximately 70 cm (27 in) from the radio and HVAC control assembly breakout	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J208	Steering Wheel Wiring Harness	K34 with W1Y	In the steering wheel wiring harness, near the X200 connector	—	—
J209	Steering Wheel Wiring Harness	K34 with W1Y	In the steering wheel wiring harness, near the X200 connector	—	—
J210	Steering Wheel Wiring Harness	K34/W1Y	In the steering wheel wiring harness, near the X200 connector	—	—
J211	Instrument Panel	UD7/UFT	In the engine compartment, approximately 30 cm (11.8 in) from the windshield washer pump	—	—
J223	Instrument Panel	UVC	Adjacent to K9 Body Control Module	—	—
J241	Instrument Panel	—	In the instrument panel harness, center of the instrument panel, approximately 13.5 cm (5.3 in) from the parking assist control module breakout	—	—
J242	Instrument Panel Wiring Harness	—	In the instrument panel wiring harness	—	—
J244	Instrument Panel	—	In the instrument panel harness, left side of the instrument panel, approximately 12 cm (5 in) from the X200 breakout towards the instrument panel cluster connector	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J245	Instrument Panel	DEB/DE5	In the instrument panel harness, center of the instrument panel, approximately 30 cm (12 in) from the radio and HVAC control assembly breakout	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J246	Instrument Panel	DEB/DE5	In the instrument panel harness, center of the instrument panel, approximately 43.5 cm (17 in) from the radio and HVAC control assembly breakout	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J247	Instrument Panel	—	In the instrument panel harness, left side of the instrument panel, approximately 36 cm (14.37 in) from the C200 breakout towards the underhood fuse block	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J248	Instrument Panel	—	In the instrument panel harness, left side of the instrument panel, approximately 8 cm (3.14 in) from the C200 breakout towards the instrument panel cluster connector	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J249	Instrument Panel	—	In the instrument panel harness, right side of the instrument panel, approximately 21 cm (8 in) from the G304 breakout	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J250	Instrument Panel	—	In the instrument panel harness, right side of the instrument panel, approximately 5 cm (2.16 in) from the air temperature actuator connector breakout towards the inflatable restraint instrument panel module connector	*Instrument Panel Harness Routing - Dash Area (2 of 2)*	—
J263	Instrument Panel	TP3	In the instrument panel harness, left side of the instrument panel, approximately 36 cm (14.37 in) from the C200 breakout towards the underhood fuse block	—	—
J264	Steering Column Wiring Harness	—	In the steering wheel wiring harness, approximately 20 cm (8 in) from the X200 connector	—	—
J270	Instrument Panel	U2K/UBS	In the instrument panel harness, approximately 15 cm (6 in) from the digital radio receiver and cigar lighter connectors breakout	—	—
J271	Instrument Panel	U2K/UBS/UE1	In the instrument panel harness, approximately 7.5 cm (3 in) from the vehicle communication interface module and cigar lighter connectors breakout	—	—
J280	Instrument Panel	Cutaway without YF7	In the instrument panel harness, approximately 20 cm (7.9 in) from the body fuse block and air bag module connectors breakout	—	—
J300	Side Access Panel Wiring Harness	PRP	Slightly forward of X53A Fuse Block - Rear Body	—	—
J302	Instrument Panel	PRP	Adjacent to K9 Body Control Module	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J307	Front Headliner Wiring Harness	C69 with YF7	In the front headliner wiring harness, center of the headliner, approximately 15 cm (6 in) from the X205 breakout towards the left vanity mirror lamp connector	—	—
J308	Body Wiring Harness	C69	In the body wiring harness, left side of the passenger compartment, approximately 22 cm (9 in) from the breakout for the door jamb switch LR side	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Rear Overview (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—
J309	Side Access Panel Wiring Harness	PRP	Adjacent to X53A Fuse Block - Rear Body	—	—
J310	Body Wiring Harness	C69	In the body wiring harness, left side of the passenger compartment, approximately 32 cm (12.79 in) from the breakout for the door jamb switch left rear side	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Rear Overview (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—
J311	Body Wiring Harness	C69	In the body wiring harness, left side of the passenger compartment, approximately 5 cm (2 in) from the door jamb switch LR side breakout	• Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Rear Overview (Passenger or Cargo) • Body Harness Routing - Right Rear Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J314	Front Headliner Wiring Harness	—	In the front headliner wiring harness, center of the headliner, approximately 22 cm (8.5 in) from the X205 breakout towards the left vanity mirror lamp connector	—	—
J315	Chassis Wiring Harness	—	In the chassis wiring harness, left side frame, approximately 31 cm (12 in) from the G300 breakout	—	—
J322	Body Wiring Harness	Cargo/Passenger with AU3	In the body wiring harness, near the front passenger seat, approximately 40 cm (16 in) from the X306 breakout	—	—
J323	Body Wiring Harness	Cargo/Passenger with AU3	In the body wiring harness, near the front passenger seat, approximately 20 cm (8 in) from the X306 breakout	—	—
J330	Rear Headliner Wiring Harness	Passenger	In the rear headliner wiring harness, center of the headliner, approximately 30 cm (12 in) to the courtesy reading lamp rear breakout	—	—
J331	Body Wiring Harness	Passenger	In the body wiring harness, near the front passenger seat, approximately 15 cm (6 in) from the X306 breakout	*Body Harness Routing - Rear Overview (Passenger or Cargo)*	—
J332	Front Headliner Wiring Harness	DH6 with YF7	In the front headliner wiring harness, center of the headliner, approximately 11 cm (4 in) from the front right sunshade breakout	—	—
J333	Front Headliner Wiring Harness	DH6 without YF7	In the front headliner wiring harness, center of the headliner, approximately 20 cm (8 in) from the right sunshade breakout	—	—
J334	Body Wiring Harness	UVC	Approximately 5 inches rearward of X53A Fuse Block - Rear Body	• *Body Harness Routing - Left Front Passenger Compartment* • *Body Harness Routing - Right Front of Passenger Compartment (1 of 2)*	—
J348	Side Access Panel Wiring Harness	PRP	In the cargo area, in-between the headliner and the roof, in-between the left side access panel and the right side access panel	—	—
J350	Side Access Panel Wiring Harness	PRP with UF2	In the cargo area, in-between the headliner and the roof, in-between the left side access panel and the right side access panel	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J355	Front Headliner Wiring Harness	C69 with YF7	In the front headliner wiring harness, center of the headliner, approximately 61 cm (24 in) from the X205 breakout towards the left vanity mirror lamp connector	Body Harness Routing - Rear Overview (Passenger or Cargo)	—
J356	Body Wiring Harness	—	In the body wiring harness, on the left front side of the vehicle, approximately 20 cm (7.87 in) from the underhood fuse block breakout	• Body Harness Routing - Left Front Passenger Compartment • Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo) • Body Harness Routing - Rear Overview (Passenger or Cargo) • Body Harness Routing - Right Front of Passenger Compartment (1 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—
J357	Body Wiring Harness	—	In the body wiring harness, approximately 9.0 cm (3.54 in) from the breakout for X307	Body Harness Routing - Rear Overview (Passenger or Cargo)	—
J359	Body Wiring Harness	U80	In the body wiring harness, approximately 20.0 cm (7.9 in) from the multi-axis acceleration sensor module breakout	Body Harness Routing - Rear Overview (Passenger or Cargo)	—
J373	Body Wiring Harness	Passenger	At the base of the right C-pillar	Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—
J374	Body Wiring Harness	Cargo without YF7	In the body wiring harness, approximately 20 cm (7.9 in) from the dome lamp – left roof rail breakout	—	—
J375	Body Wiring Harness	Cargo without YF7	In the body wiring harness, approximately 20 cm (7.9 in) from the dome lamp – right roof rail breakout	Body Harness Routing - Right Front of Passenger Compartment (2 of 2)	—
J376	Body Wiring Harness	Cargo/Passenger	In the body wiring harness, approximately 72.5 cm (28.5 in) from the X410 breakout	• Body Harness Routing - Right Front of Passenger Compartment (2 of 2) • Body Harness Routing - Right Rear Passenger Compartment (2 of 2)	—
J377	Side Access Panel Wiring Harness	PRP	Adjacent to X53A	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J378	Side Access Panel Wiring Harness	PRP	Adjacent to X53A	—	—
J387	Chassis Wiring Harness	Cutaway	In the chassis wiring harness, approximately 6 cm (2.36 in) from the trailer connector breakout	—	—
J388	Chassis Wiring Harness	Cutaway	In the chassis wiring harness, approximately 10 cm (3.94 in) from the trailer connector breakout	—	—
J401	Body Wiring Harness	C36/C49/C69	In the body wiring harness, in the left rear of the vehicle, approximately 21 cm (8 in) from the X401 breakout	• *Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo)* • *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)*	—
J402	Chassis Wiring Harness	—	In the chassis wiring harness, left frame, approximately 20 cm (7.87 in) from the G400 breakout towards the EBCM connector	—	—
J403	Body Wiring Harness	Cargo/Passenger	In the body wiring harness, left rear of the passenger compartment, approximately 18.5 cm (7 in) from the X402 breakout	• *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—
J404	Chassis Wiring Harness	—	In the chassis wiring harness, left frame, approximately 10 cm (4 in) from the G400 breakout towards the EBCM connector	—	—
J405	Rear HVAC Wiring Harness	C36/C69	In the rear HVAC wiring harness, left rear of the passenger compartment, approximately 13 cm (5.31 in) from the auxiliary blower motor relay breakout towards X409	—	—
J406	Chassis Wiring Harness	LWN	Within the chassis wiring harness	—	—
J407	Rear Headliner Wiring Harness	Passenger	In the rear headliner wiring harness, center of the headliner, approximately 6.5 cm (2.5 in) from X304 towards the rear courtesy/reading lamp connector	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J408	Side Access Panel Wiring Harness	PRP	In the Left Side Access Panel compartment	—	—
J409	Side Access Panel Wiring Harness	PRP	In the Right Side Access Panel compartment	—	—
J410	Body Wiring Harness	Cargo/Passenger	In the body wiring harness, in the left rear of the vehicle, approximately 47 cm (18 in) from the X401 breakout	• *Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo)* • *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Front of Passenger Compartment (2 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—
J411	Rear HVAC Wiring Harness	C69	In the rear HVAC wiring harness, left rear of the passenger compartment, approximately 20 cm (8 in) from the blower motor relay breakout, towards X409	—	—
J412	Rear HVAC Wiring Harness	C36/C69	In the rear HVAC wiring harness, left rear of the passenger compartment, approximately 7 cm (2.8 in) from the blower motor relay breakout towards X409	—	—
J413	Rear HVAC Wiring Harness	C36/C70	In the rear HVAC wiring harness, left rear of the passenger compartment, approximately 10 cm (4 in) from the auxiliary blower motor resistor assembly breakout	—	—
J420	Rear Bumper Wiring Harness	UD7	In the rear bumper wiring harness, approximately 57 cm (22 in) from the right rear middle object alarm sensor towards the left rear corner object alarm sensor	—	—
J421	Rear Bumper Wiring Harness	UD7	In the rear bumper wiring harness, approximately 15 cm (6 in) from the left rear corner object alarm sensor towards the right rear middle object alarm sensor	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J422	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 11.5 cm (4.5 in) from the wheel speed sensor - left front breakout	—	—
J423	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 30 cm (11.8 in) from the wheel speed sensor - left front	—	—
J425	Parking Aid Jumper Wiring Harness	UFT	At the rear of the vehicle	*Rear Bumper Harness Routing*	—
J426	Parking Aid Jumper Wiring Harness	UFT	At the rear of the vehicle	*Rear Bumper Harness Routing*	—
J427	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 22.5 cm (8.86 in) from the exhaust temperature sensor 4	—	—
J428	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 29 cm (11.4 in) from the exhaust temperature sensor 4	—	—
J429	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 38 cm (14.96 in) from the diesel particulate filter exhaust differential pressure sensor	—	—
J430	Chassis Wiring Harness	LWN	In the chassis wiring harness, approximately 30 cm (11.8 in) from the exhaust aftertreatment fuel injector	—	—
J431	Chassis Wiring Harness	L8T/LV1	In the chassis wiring harness, approximately 15 cm (5.9 in) from the fuel pump driver control module	*Chassis Harness Routing*	—
J450	Body Wiring Harness	—	In the body wiring harness, in the rear of the vehicle, approximately 10 cm (3.93 in) from the X415 breakout	• *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—
J451	Body Wiring Harness	—	In the body wiring harness, in the rear of the vehicle, approximately 17 cm (6.5 in) from the X415 breakout	• *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J452	Body Wiring Harness	—	In the body wiring harness, approximately 17 cm (6.5 in) from the X419 breakout	• *Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo)* • *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—
J453	Body Wiring Harness	—	In the body wiring harness, in the left rear of the vehicle, approximately 10 cm (4 in) from the X419 breakout	• *Body Harness Routing - Left Rear Passenger Compartment (Passenger or Cargo)* • *Body Harness Routing - Rear Overview (Passenger or Cargo)* • *Body Harness Routing - Right Rear Passenger Compartment (1 of 2)* • *Body Harness Routing - Right Rear Passenger Compartment (2 of 2)*	—
J500	Driver Door Wiring Harness	AU3/DEB/DE5/A31	In the left front door wiring harness, driver door, approximately 7 cm (3 in) from the left front door speaker breakout	—	—
J501	Driver Door Wiring Harness	AU3	In the left front door wiring harness, driver door, approximately 6 cm (2.36 in) from the driver outside rearview mirror breakout	—	—
J502	Driver Door Wiring Harness	DEB/DE5	In the left front door wiring harness, driver door, approximately 4 cm (2 in) from the left front door speaker breakout	—	—
J600	Passenger Door Wiring Harness	AU3/DEB/DE5/A31	In the right front door wiring harness, front passenger door, approximately 4 cm (2 in) from the passenger outside rearview mirror breakout	—	—

Master Electrical Component List (cont'd)

Code	Name	Option	Location	Locator View	Connector End View
J601	Passenger Door Wiring Harness	AU3	In the right front door wiring harness, front passenger door, approximately 5 cm (2 in) from the passenger outside rearview mirror breakout	—	—
J901	Right Rear Cargo Door Wiring Harness	Cargo/Passenger with AU3	In the rear cargo door wiring harness, approximately 4 cm (1.5 in) from the X902 breakout	—	—
J902	Right Rear Cargo Door Wiring Harness	Cargo/Passenger with C49	In the right rear door wiring harness, right rear cargo door, approximately 12 cm (4.7 in) from the X902 breakout	*Rear Cargo Doors Harness Routing (Passenger or Cargo)*	—
JX200	Instrument Panel Wiring Harness	—	In the instrument panel wiring harness, left front side of the floor, where the carpet ends behind the brake pedal next to JX250	*Instrument Panel Harness Routing - Dash Area (1 of 2)*	*JX200 Splice Pack*
JX250	Instrument Panel Wiring Harness	—	In the instrument panel wiring harness, left front side of the floor, where the carpet ends behind the brake pedal next to JX200	*Instrument Panel Harness Routing - Dash Area (1 of 2)*	*JX250 Splice Pack*
JX347	Body Wiring Harness	—	In the body wiring harness, left side of the passenger compartment, attached to the lower left B-pillar part of G347	• *Body Harness Routing - Left Front Passenger Compartment* • *Body Harness Routing - Right Front of Passenger Compartment (2 of 2)*	*JX347 Splice Pack*
JX348	Body Wiring Harness	—	In the body wiring harness, right side of the passenger compartment, attached to the lower right B-pillar part of G348	*Body Harness Routing - Right Front of Passenger Compartment (1 of 2)*	*JX348 Splice Pack*

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Section 7

Safety and Security

Immobilizer 7-3
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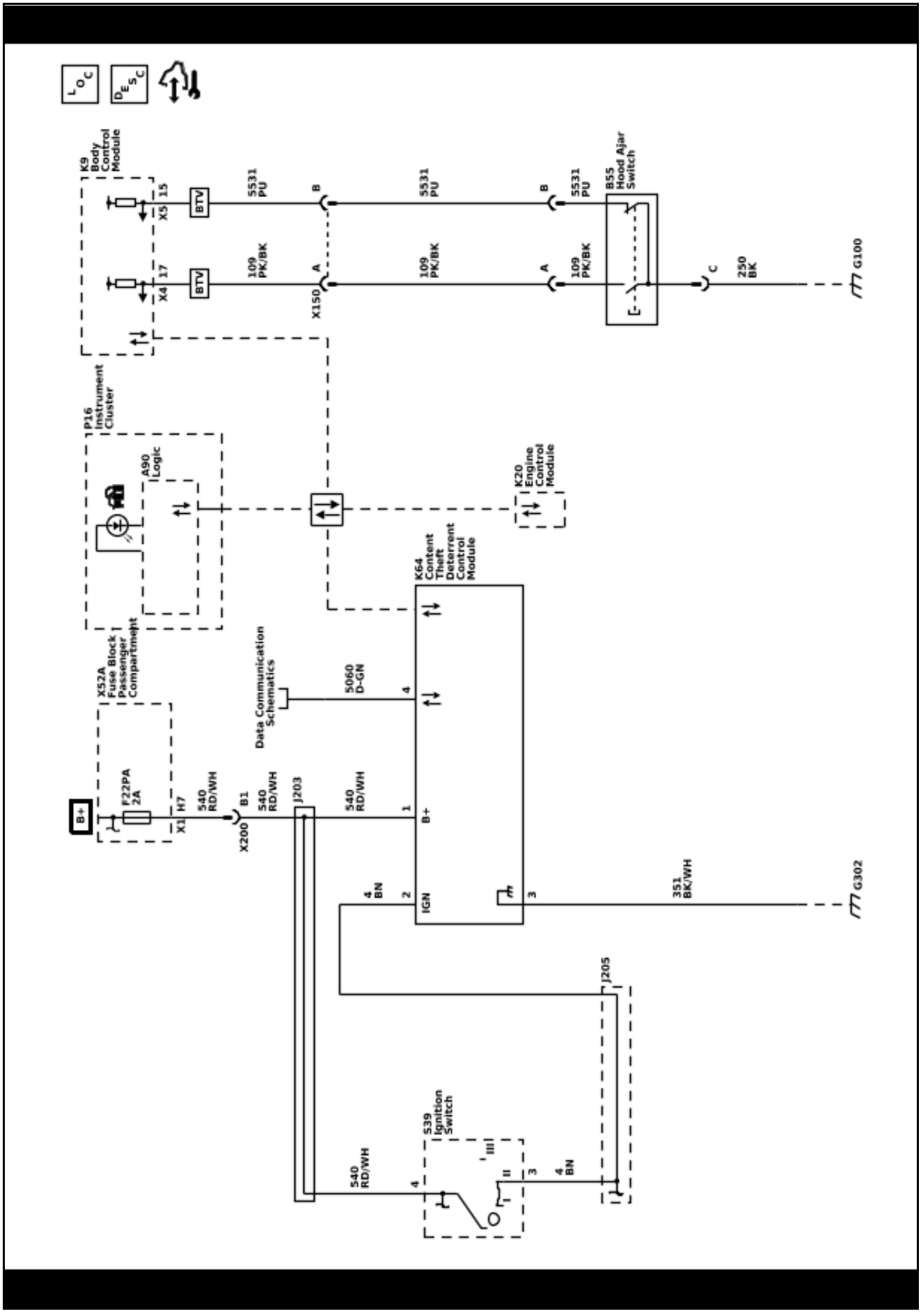
Immobilizer

Schematic and Routing Diagrams

Immobilizer Schematics (Immobilizer)



Description and Operation

Immobilizer Description and Operation

The immobilizer system functions are provided by the theft deterrent module (TDM) and the engine control module (ECM). When an ignition key is inserted into the ignition lock cylinder and the ignition is switched ON, the transponder embedded in the head of the key is energized by the exciter coil surrounding the ignition lock cylinder. This exciter coil is part of the TDM. The energized transponder transmits a signal that contains its unique value, which is received by the TDM. The TDM then compares this value to a value stored in memory. If the values match, the TDM will send the prerelease password via the serial data circuit to the ECM. If the transponders unique value is incorrect, the TDM will send the fuel disable password to the ECM.

When the ECM receives the TDM prerelease password, the ECM will challenge the password. The ECM sends this challenge back to the TDM via the serial data circuit. Both the ECM and TDM perform a calculation on this challenge. If the calculated response from the TDM equals the calculation performed by the ECM, the ECM will allow vehicle starting.

The components of the theft system are as follows:

- TDM
- ECM
- Ignition key (Transponder)
- Security indicator

Theft Deterrent Module (TDM)

Vehicles with steering column mounted ignition switches have the exciter integral with the theft deterrent module (TDM), which is located within the steering column. The TDM can learn up to 10 keys (transponder values).

The TDM uses the following inputs:

- Battery voltage
- Ignition switched voltage
- Ground circuit

The theft deterrent control module uses the following outputs:

- Password exchange
- Challenge/response with the engine control module (ECM)

When an ignition key is inserted into the ignition lock cylinder and the ignition is switched ON, the transponder embedded in the head of the key is energized by the exciter coils surrounding the ignition lock cylinder. The energized transponder transmits a signal that contains its unique value, which is received by the TDM. The TDM then compares this value to the learned key code stored in memory. The TDM then performs one of the following functions:

- If the transponder value matches the values stored in the TDM memory, the TDM will send the prerelease password to the ECM via the serial data circuit.
- If the transponders unique value does not match the value stored in the TDM, the TDM will send the fuel disable message to the ECM via the serial data circuit.
- If the TDM is unable to measure the ignition key transponder value, the TDM will not send any messages to the ECM.

Engine Control Module (ECM)

When the engine control module (ECM) receives the theft deterrent module (TDM) prerelease password, the ECM will challenge the password. The ECM sends this challenge back to the TDM via the serial data circuit. Both the ECM and TDM perform a calculation on this challenge. If the calculated response from the TDM equals the calculation performed by the ECM, the ECM will allow vehicle starting.

The ECM will disable vehicle starting if any of the following conditions occur:

- The prerelease password is invalid.
- The fuel disable password is sent by the TDM.
- No passwords are received. There is no communication with the TDM.
- The TDM calculated response to the challenge does not equal the calculation performed by the ECM.

The Ignition Key (Transponder)

Note: The ignition key will be stamped with a + or a + surrounded by a circle. This symbol only identifies the key as a PassKey III+ transponder key and is not a reliable way to determine if a particular key is the correct key for a vehicle. Service parts may have a different stamped symbol than the production part. The only way to determine the proper key for a vehicle is by referencing the parts catalog.

The ignition key for PassKey III+ (PK3+) equipped vehicles is a standard ignition key with a transponder located in the plastic head of the key. The transponder value is fixed and unable to be changed. The immobilizer system uses the ignition key transponder value to determine if a valid ignition key is being used to start the vehicle. There are approximately 3 trillion possible transponder values. There are no visible electrical contacts. The immobilizer system use the following types of ignition keys:

Master Keys

Master keys have a black plastic head for full access operation of the vehicle. Master keys may perform the following functions:

- Start the vehicle.
- Lock/unlock all of the door locks and rear compartment.
- Lock/unlock all of the storage compartments.

Valet Keys

Important: Valet keys are NOT standard equipment on all GM vehicle lines.

Valet keys have a gray plastic head and are for restricted operation of the vehicle. Valet keys may perform the following functions:

- Start the vehicle.
- Lock/unlock all of the door locks.

Fleet Keys

Important: Fleet keys are NOT standard equipment on all GM vehicle lines.

Fleets keys allow full access to the vehicle just as a master key would. However, unlike a master key which may only learn 10 keys to a particular vehicle, an unlimited number of fleet keys may be learned to the vehicle. Fleet keys are only used in vehicles configured for fleet use with RPO 6E2 or 6E8.

- Start the vehicle.
- Lock/unlock all of the door locks and rear compartment.
- Lock/unlock all of the storage compartments.

Security Indicator

The theft deterrent module (TDM) can command the instrument panel cluster (IPC) to illuminate the security indicator only when the ignition key is in the ON position. The TDM will command the security indicator be illuminated any time a fault is noted in the immobilizer system and when the engine starting is disabled.

Remote Vehicle Speed Limiting Description and Operation

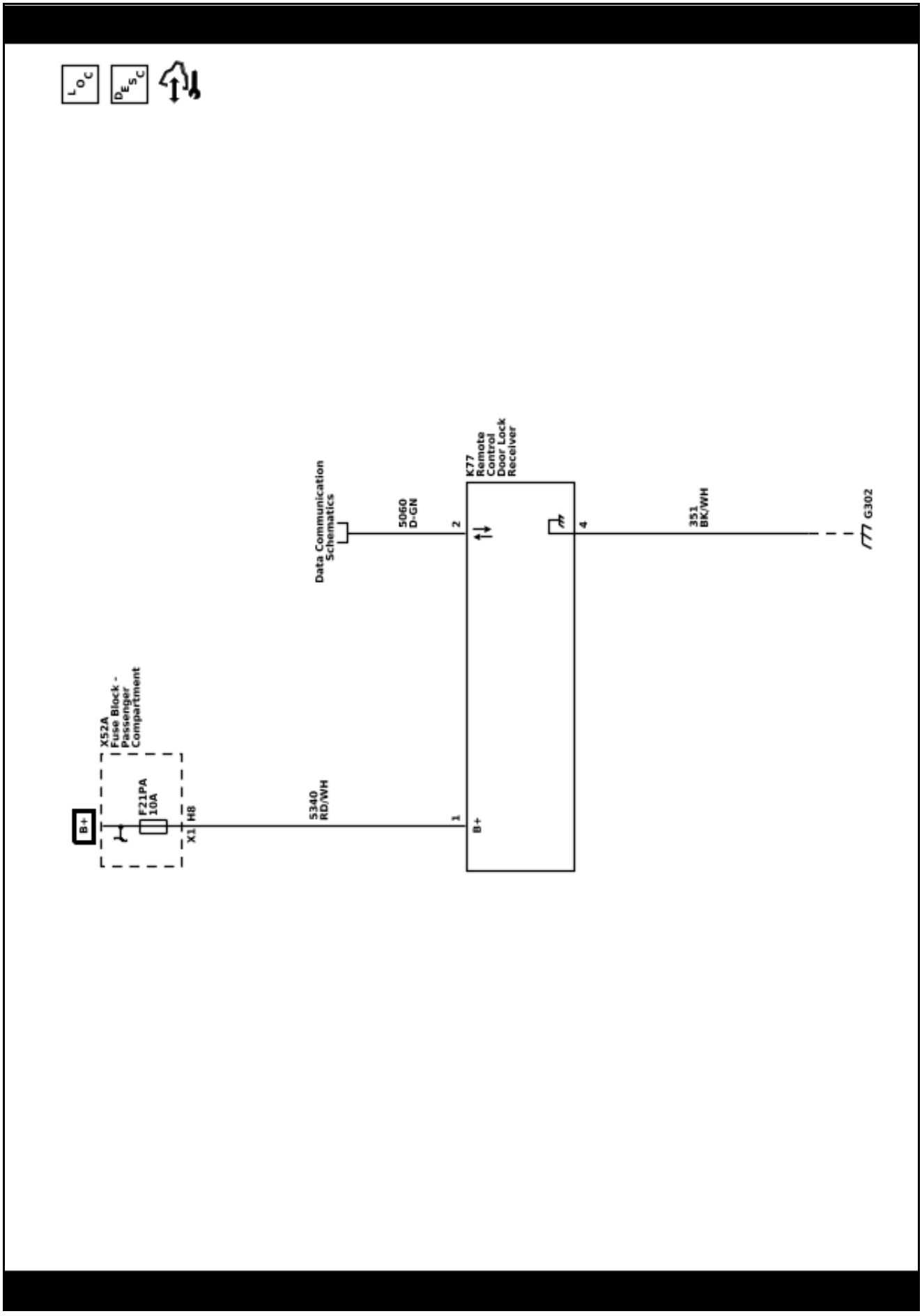
Certain vehicles equipped with OnStar® now have an additional feature that allows for remote limiting of the vehicle's speed. This OnStar® feature is called Stolen Vehicle Slow-Down and is now part of the OnStar® Stolen Vehicle Assistance service. This feature, when used in conjunction with local law enforcement and strict guidelines at the OnStar® Call Center, will slow the vehicle by interacting with the engine control system.

When the engine control system receives a valid request from the OnStar® telematics communications interface module, it will enter into a reduced engine power/vehicle speed limiting mode, which will decelerate the vehicle. Once the request is active the engine control module begins reducing engine torque to match requested vehicle speed and a REDUCED ENGINE POWER indication is displayed. No DTCs will be set during this process.

Remote Functions

Schematic and Routing Diagrams

Remote Function Schematics (Keyless Entry (ATG or UJM))



Description and Operation

Keyless Entry System Description and Operation

The keyless entry system is a vehicle entry device. The keyless entry system is used in conjunction with the body control module (BCM) to remotely activate certain vehicle features. Keyless entry will lock/unlock the doors when a corresponding button on the keyless entry transmitter is pressed. This is accomplished by the transmitter sending a radio frequency to the remote control door lock receiver (RCDLR). The RCDLR interprets the signal and activates the requested function via a serial data message to the BCM. A low transmitter or vehicle battery or radio frequency (RF) interference from aftermarket devices, such as 2-way radios, power inverters, computers, etc., may cause a system malfunction. High RF traffic areas may also cause interference that could lead to a malfunction. Keyless entry allows you to operate the following components:

- Door locks
- Cargo door unlock
- Vehicle locator/Panic alarm
- Illuminated entry lamps

The keyless entry system has the following components:

- Keyless entry transmitters
- BCM
- RCDLR

Keyless Entry Transmitters

The keyless entry transmitter are used to lock and unlock the vehicle doors from a distance of up to 65 feet (20 m) away. Up to 8 transmitters may be programmed to a single vehicle.

OnStar® Remote Link

A vehicle operator may have the ability to perform some of the keyless entry functions using applications on personal devices such as smart phones. Refer to OnStar Description and Operation.

Remote Control Door Lock Receiver (RCDLR)

The remote control door lock receiver (RCDLR) is a multifunction module that operates both the keyless entry system as well as the tire pressure monitoring (TPM) system. The RCDLR has an internal antenna that is used to receive radio frequency (RF) communications sent by the keyless entry transmitters. When an RF message is received from a keyless entry transmitter, the RCDLR interprets this signal and will request via serial data that the body control module (BCM) perform the specific function, i.e. door lock, door unlock, or vehicle locate. The RCDLR also receives RF signals from the TPM sensors located at each wheel.

Unlock Driver Door Only

Momentarily press the transmitter UNLOCK button in order to perform the following functions:

- Unlock only the driver door.
- Illuminate the interior lamps for a determined length of time, or until the ignition is turned ON.
- Flash the exterior lights, if enabled through personalization.

Unlock All Doors – Second Operation

Momentarily press the transmitter UNLOCK button a second time, within 5 seconds of the first press, to perform the following functions:

- Unlock the remaining doors.
- Unlock the cargo doors.

Cargo Door Unlock

Momentarily press the transmitter cargo door unlock button a second time, within 5 seconds of the first press, to perform the following function:

Unlock only the cargo doors.

Lock All Doors

Press the transmitter LOCK button to perform the following functions:

- Lock all vehicle doors.
- Immediately turn OFF the interior lamps.
- Flash the exterior lights, if enabled through personalization.
- Chirp the horn, if enabled through personalization.

Vehicle Locator/Panic Alarm

A single press of the panic button performs the following functions. Some functions may be dependent on personalization settings:

- Pulse the horn three times.
- Flash the exterior lamps three times.

A press and hold of the panic button performs the following functions:

- Illuminate the interior lamps.
- Pulse the horn and flash the exterior lamps for 30 second or until the following conditions occur:
  - The panic button is pressed.
  - The ignition switch is turned to the RUN position with a valid key.

Remote Vehicle Start (RVS) – if equipped

The remote vehicle start (RVS) function allows engine starting while not in the vehicle. It also allows the vehicle HVAC system and other vehicle systems to enable, providing a comfortable vehicle upon entry. RVS functions have an operating range of up to 195 feet, depending on conditions. The RVS sequence begins by pressing and releasing the lock button and then pressing and holding the RVS buttons on the keyless entry transmitter. The turn signal lamps will illuminate to indicate the vehicle has received the remote start request. Each time an RVS is performed, the vehicle doors are locked, however they may then be unlocked/locked with the transmitter or vehicle key

at any time. Once activated, the engine is allowed to run for 10 minutes. The RVS time may be extended by an additional 10 minute by again pressing and releasing the lock button and then pressing and holding the RVS buttons on the transmitter. This feature is called a RVS continue and allows a maximum of 20 minutes of engine running. If the RVS continue is performed at 7 minutes into the initial 10 minute time-out, a total of 17 minutes of engine running would occur. The RVS event may be suspended at any time by pressing only the RVS button on the transmitter or by entering the vehicle and turning ON the hazard lamps.

In between ignition cycles, only two RVS events may occur or be attempted. Once two events or attempts have been made, future RVS events will be suspended until the vehicle is started using the ignition.

Enable/Disable RVS

Using the driver information center (DIC), RVS may be enabled or disabled as a part of vehicle personalization. Refer to the vehicle owners manual for more information.

Hood Ajar Switch

The hood switch provides status of the hood to the BCM for RVS purposes. The switch is integrated into the hood latch assembly. The hood ajar switch provides 2 separate inputs to the BCM. These separate inputs allow the BCM to actively monitor for a hood ajar switch fault.

RVS Circuit Description

The RCDLR receives a signal from the keyless entry transmitter indicating a RVS request. A message is then sent to the BCM which determines if a crank request message will be sent to the ECM to allow engine starting. To determine if conditions are correct for an RVS event, the BCM will ensure the following conditions are met:

- All vehicle doors are closed
- A valid hood ajar switch closed signal is present
- The doors are locked
- The hazard switch is OFF
- The vehicle power mode is correct
- No content theft deterrent (CTD) alarm triggers are present
- The vehicle is not in valet mode (if equipped)

When the BCM determines all conditions meet those required for an RVS event, a message is sent via serial data to the ECM. The ECM relies on the RVS message from BCM to enable RVS when the crank request signal is received. If the ECM does not receive a valid RVS message, it will not attempt to start the engine. While the ECM is in RVS mode it will suspend engine operation if any of the following additional conditions occur:

- Vehicle speed is greater than 0
- Transmission is not in PARK
- Excessive engine coolant temperature
- Low oil pressure
- The malfunction indicator lamp (MIL) is commanded ON
- Engine crank time is greater than 30 seconds
- Excessive engine speed
- Accelerator pedal position too high
- Remote start timer equals 0
- Immobilizer system indicates tamper

Keyless Entry Personalization

Vehicle lock/unlock functions and remote vehicle start (RVS) settings may be personalized. For functional descriptions and personalization instructions, refer to the vehicle owners manual.

Rolling Code

The Keyless Entry System uses rolling code technology. Rolling code technology prevents anyone from recording the message sent from the transmitter and using the message in order to gain entry to the vehicle. The term “rolling code” refers to the way that the Keyless Entry System sends and receives the signals. The transmitter sends the signal in a different order each time. The transmitter and the remote control door lock receiver (RCDLR) are synchronized to the appropriate order. If a programmed transmitter sends a signal that is not in the order that the RCDLR expects, then the transmitter is out of synchronization. This occurs after 256 presses of any transmitter button when it is out of range of the vehicle.

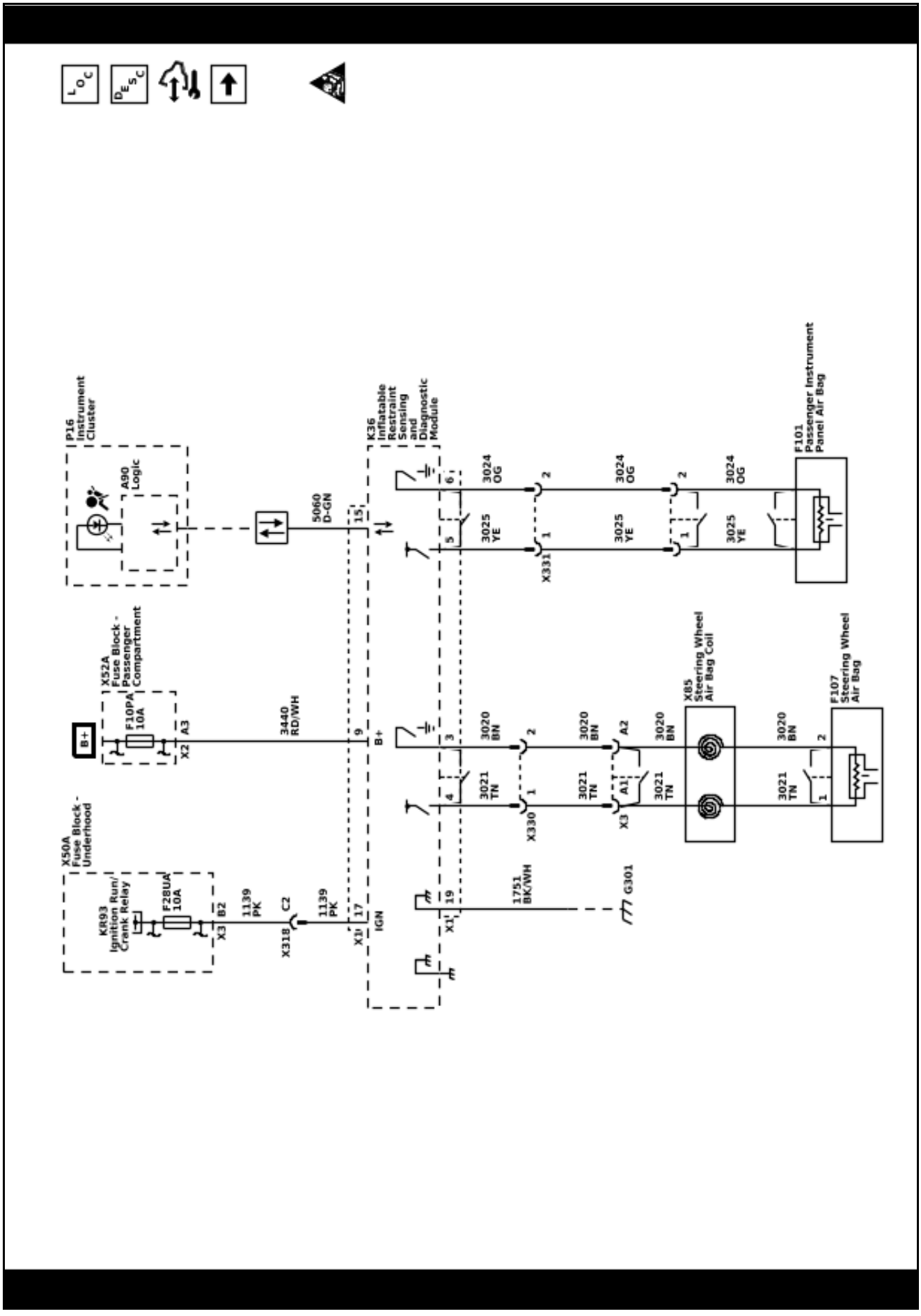
Automatic Synchronization

The keyless entry transmitters do not require a manual synchronization procedure. If needed, the transmitters automatically re-synchronize when any button on the transmitter is pressed within range of the vehicle. The transmitter will operate normally after the automatic synchronization.

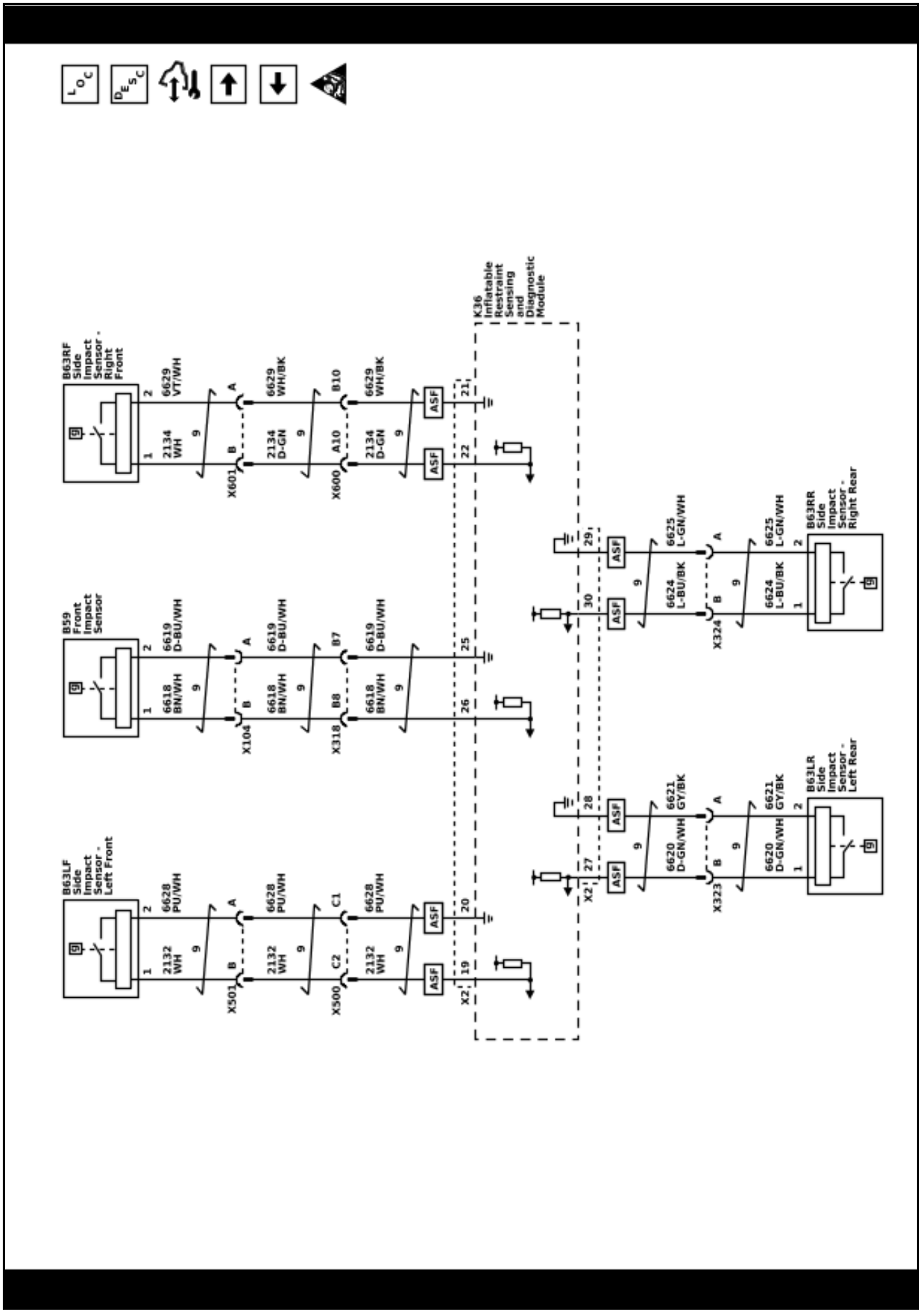
Supplemental Restraints

Schematic and Routing Diagrams

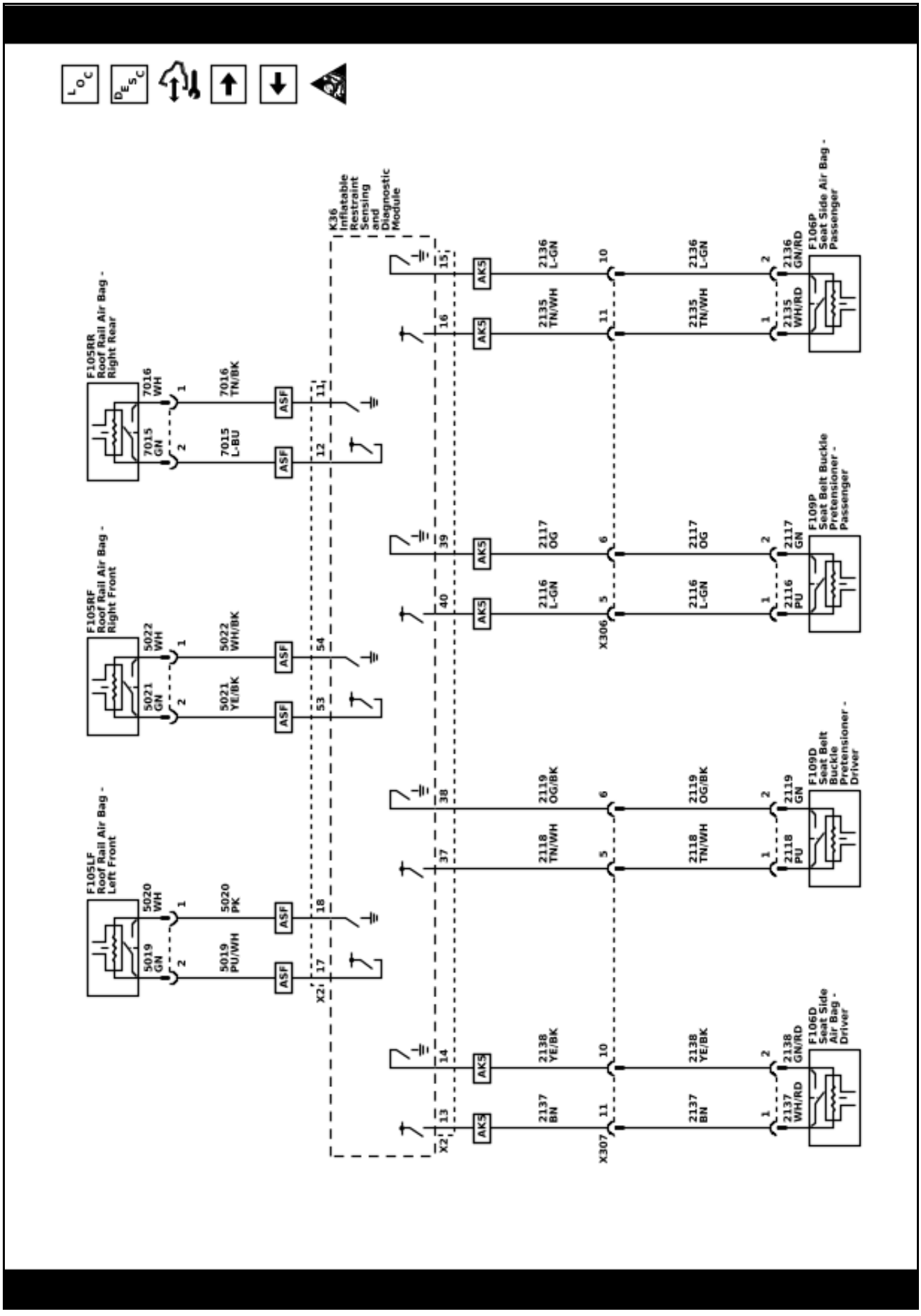
SIR Schematics (Module Power, Ground, Serial Data, and Front Air Bags)



SIR Schematics (Impact Sensors)



SIR Schematics (Roof Rail Air Bags, Seat Side Air Bags, and Seat Belt Pretensioners)



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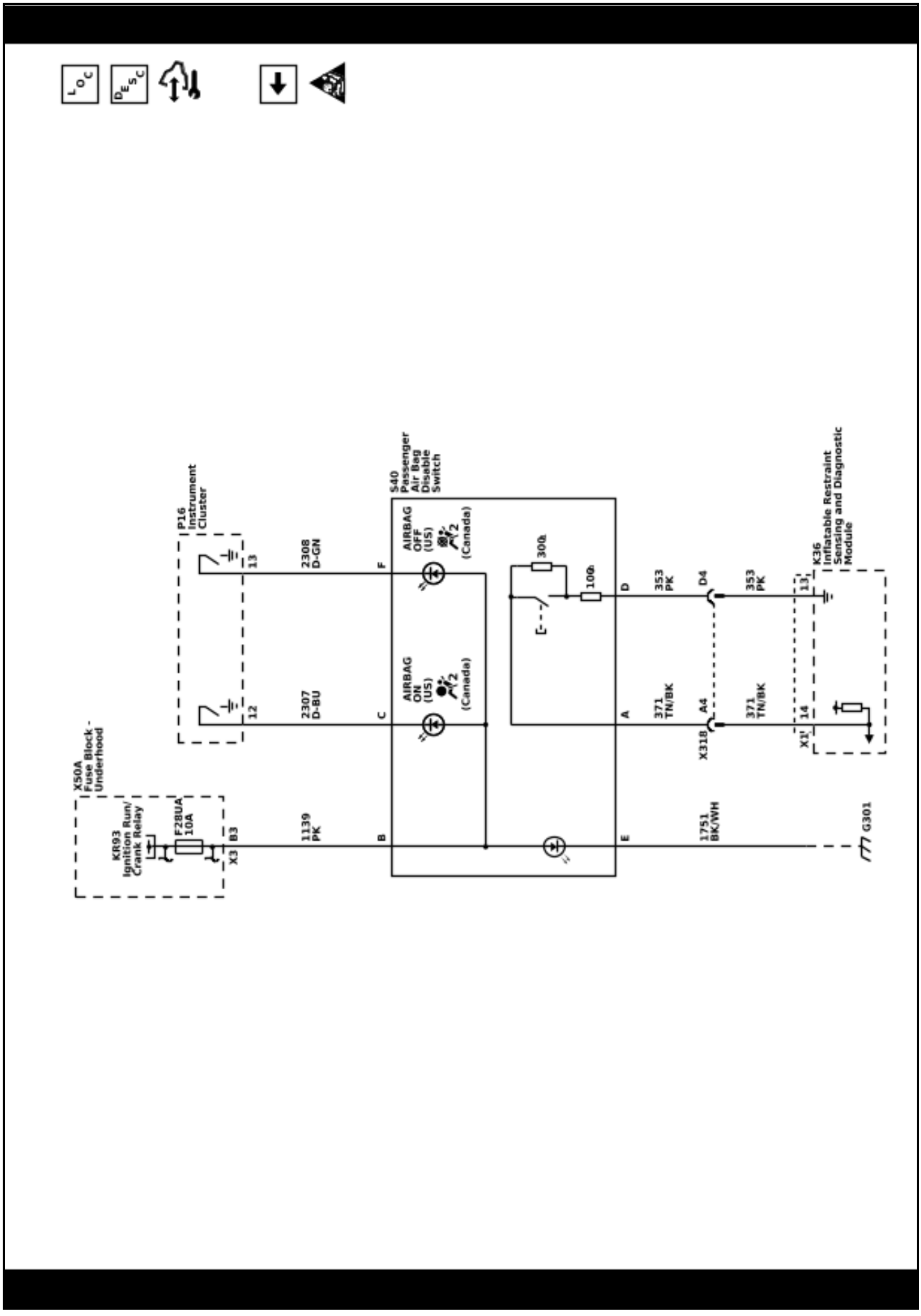
SIR Schematics (Passenger Air Bag Disable Switch (C99))



Description and Operation

Supplemental Inflatable Restraint System Description and Operation

The supplemental inflatable restraint (SIR) system, comprised of the inflatable restraint sensing and diagnostic module (SDM), impact sensors, air bags, and seat belt pretensioners, supplements the protection offered by the seat belts. The SDM determines the severity of a collision using data collected from impact sensors located at strategic points on the vehicle. When the SDM detects a collision, it processes the information provided by the sensors to provide the safest combination of air bag and pretensioner deployment. The SDM will deploy the air bags and pretensioners if it detects a collision of sufficient force. If the force of the impact is not sufficient to warrant air bag deployment, the SDM may still deploy the seat belt pretensioners. The SDM contains a sensing device that translates vehicle acceleration to an electrical signal. The SDM compares these signals to the threshold values stored in memory. If the signals exceed the stored threshold value, the SDM will determine the severity of the event and may deploy restraints. The SDM continuously monitors the deployment loops and electrical components for malfunctions. Upon detection of a circuit malfunction, the SDM will set a DTC and illuminate the SIR system air bag malfunction indicator. The steering column and knee bolsters are designed to absorb energy and compress during frontal collisions to limit leg movement and decrease the chance of injury to the driver and passenger.

The supplemental inflatable restraint system utilizes the following components:

- Inflatable Restraint Sensing and Diagnostic Module
- Air Bag Indicator
- Air Bags
- Seat Belt Pretensioners
- Impact Sensors
- Passenger Presence System
- Passenger Air Bag Indicator
- Passenger Air Bag Disable Switch
- Seat Belt Indicators

Inflatable Restraint Sensing and Diagnostic Module

The SDM is the control unit for the SIR system. The SDM contains internal sensors in addition to the external impact sensors. The SDM contains sensor which translate vehicle acceleration into an electrical signal, which may be used by other modules. In the event of a collision, the SDM compares the signals from the internal and external impact sensors to a threshold value stored in memory. When the generated signals exceed the stored value, the SDM will cause current to flow through the appropriate deployment loops to deploy the restraints. The SDM records the SIR system status when a deployment occurs and illuminates the air bag malfunction indicator. The SDM performs continuous diagnostic monitoring of the SIR system electrical components and circuitry when the ignition is on. If the SDM detects a malfunction, a DTC will set and the SDM will command the instrument cluster to illuminate the air bag malfunction indicator, notifying the driver that a malfunction exists. If power is lost during a collision, the SDM maintains a 23 V loop reserve for deployment of the air bags. It is important when disabling the SIR system for servicing or rescue operations to allow the 23 V loop reserve to dissipate, which could take up to 1 minute.

Air Bag Indicator

The SIR system air bag indicator, located in the instrument cluster, is used to notify the driver of SIR system malfunctions and verify that the SDM is communicating with the instrument cluster. When the ignition is turned on, the SDM is supplied with ignition voltage. The instrument cluster will momentarily turn on the SIR system air bag indicator. While the indicator is on, the SDM conducts tests on all SIR system components and circuits. If no malfunctions are detected the SDM will communicate with the instrument cluster through the serial data circuit and command the SIR system air bag malfunction indicator to turn off. The SDM provides continuous monitoring of the air bag circuits by conducting a sequence of checks. If a malfunction is detected the SDM will set a DTC and command the instrument cluster to illuminate the SIR system air bag malfunction indicator via serial data. The presence of an SIR system malfunction could result in non-deployment of the inflatable restraints or deployment in conditions that normally would not warrant deployment. The SIR system air bag malfunction indicator will remain on until the malfunction has been repaired.

Air Bags

The vehicle will contain a number of air bags, depending on vehicle available and optional equipment:

- Steering wheel
- Instrument panel
- Driver seat
- Passenger seat
- Left roof rail
- Right roof rail

To view the locations of the air bags refer to: *Master Electrical Component List on page 6-53*.

The steering wheel and instrument panel air bag are a single-stage design. The air bags contain a housing, inflatable air bag, an initiating device, a canister of gas generating material and, in some cases, stored compressed gas. Each air bag has a discrete deployment loop to supply current and deploy the air bag. The current passing through the air bags ignite the material in the canister producing a rapid generation of gas and is some cases, the release of compressed gas. The gas produced from this reaction rapidly inflates the air bag. Once the air bag is inflated, it deflates through the air bag vent holes and/or the bag fabric. A shorting bar (if equipped) is located in the connector.

Seat Belt Pretensioners

The vehicle will contain a number of seat belt pretensioners, depending on vehicle available and optional equipment:

- Driver – Seat belt anchor
- Driver – Seat belt retractor
- Passenger – Seat belt anchor
- Passenger – Seat belt retractor

To view the locations of the seat belt pretensioners refer to: *Master Electrical Component List on page 6-53*
.

The seat belt pretensioners consist of a housing, seat belt retractor, seat belt anchor, seat belt webbing, initiator, and a canister of gas generating materials. The initiator is part of the seat belt pretensioner deployment loop. When the vehicle is involved in a collision of sufficient force, the SDM causes current to flow through the seat belt deployment loops to the initiator. Current passing through the initiator ignites the material in the canister producing a rapid generation of gas. The gas produced from this reaction deploys the seat belt pretensioners which removes the slack in the seat belts. Depending on the severity of the collision, the seat belt pretensioners may deploy without the frontal inflator modules deploying, or they will deploy immediately before the frontal inflator modules deploy. Each seat belt pretensioner connector is equipped with a shorting bar, which shorts the seat belt pretensioner circuitry to prevent unwanted deployment of the seat belt pretensioner when the connector is disconnected.

Impact Sensors

The vehicle will contain a number of impact sensors, depending on vehicle available and optional equipment:

- Front
- Front Left
- Front right
- Door
- Rear Frame Rail

To view the locations of the impact sensors refer to: *Master Electrical Component List on page 6-53*.

The impact sensors contain a sensing device which monitors vehicle acceleration to detect collisions that are severe enough to warrant air bag deployment. The impact sensors are not part of the deployment loop, but instead provide input to the SDM.

Passenger Presence System

The passenger presence system is used to monitor the type of occupant that is sitting in the front passenger seat and communicate the status to the inflatable restraint sensing and diagnostic module. The inflatable restraint sensing and diagnostic module then uses this information to determine whether to enable or suppress the deployment of the passenger instrument panel air bag. The passenger presence system consists of an electronic control module, a sensor mat in the seat, a harness, and passenger air bag ON/OFF indicators.

Passenger Air Bag Indicator

The passenger air bag indicator identifies the status of the instrument panel air bag. If an occupant is not detected in the passenger seat or the occupant type is not suitable for air bag deployment, the inflatable restraint sensing and diagnostic module will illuminate the passenger air bag OFF indicator. If an occupant is detected in the passenger seat, the inflatable restraint sensing and diagnostic module will illuminate the passenger air bag ON indicator.

Passenger Air Bag Disable Switch

The passenger air bag disable switch provides the means to manually disable the ability for the passenger instrument panel air bag to deploy. The vehicle has a passenger air bag status indicator to inform the driver when the passenger air bag is on or off based on the disable switch position.

Seat Belt Indicators

The seat belt indicators are controlled by the inflatable restraint sensing and diagnostic module. For further information on seat belt indicators refer to: Seat Belt System Description and Operation.

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Section 8

Transmission

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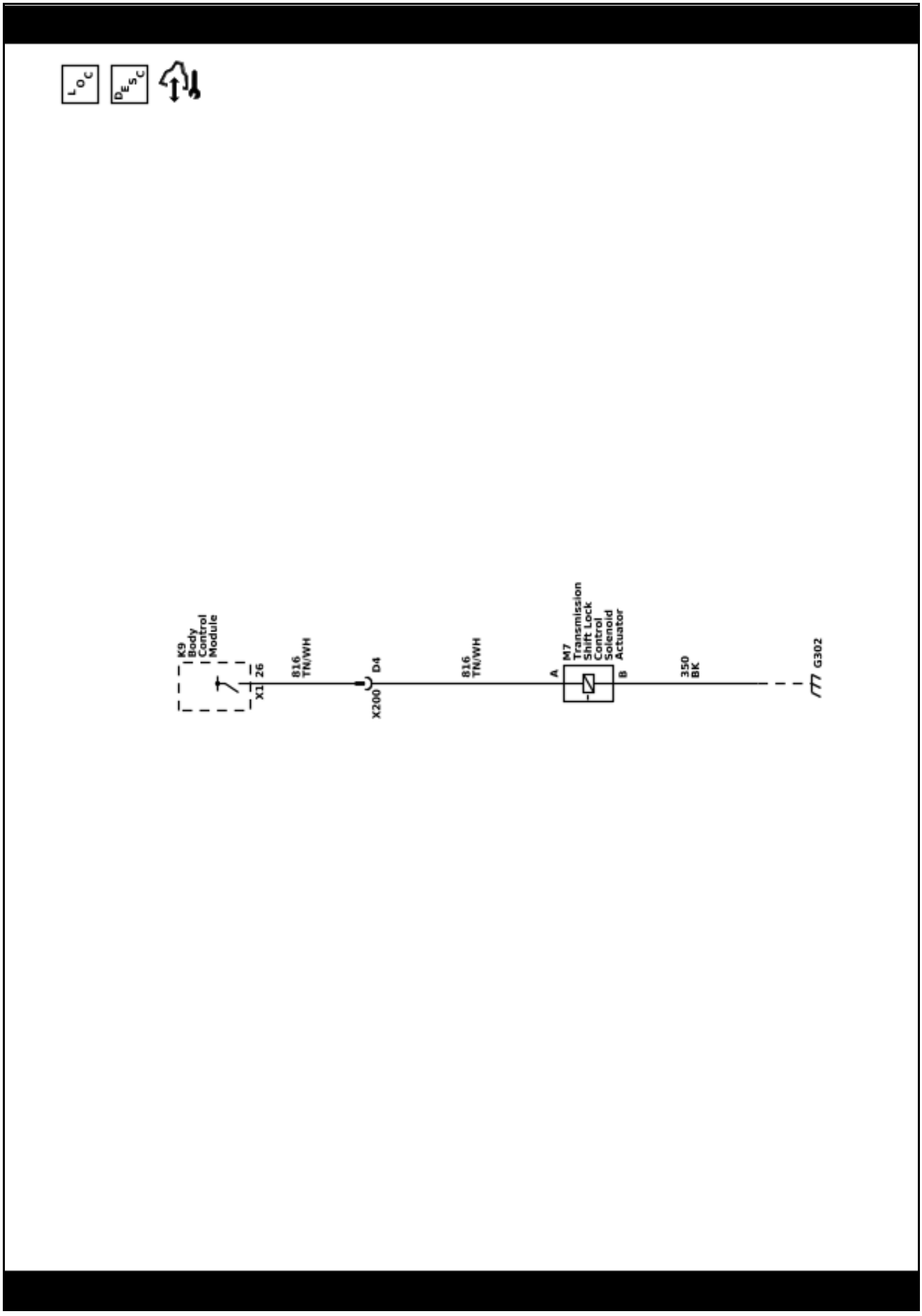
Shift Lock Control

Schematic and Routing Diagrams

Shift Lock Control Schematics (Shift Lock Control)



Description and Operation

Automatic Transmission Shift Lock Control Description and Operation

The automatic transmission shift lock control system is a safety device that prevents an inadvertent shift out of PARK when the engine is running. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consists of the following components:

- The automatic transmission shift lock solenoid (serviced as the automatic transmission shift lock actuator), as well as the body control module (BCM) and the engine control module (ECM). The shift lock solenoid is located within the floor shift control assembly with vehicles equipped with floor shift.
- The BCM controls the voltage to the shift lock control solenoid through the shift lock control solenoid controlled voltage circuit. The following conditions must be met before the BCM will remove voltage from the shift lock solenoid:
  - The ignition is in the ON position.
  - The engine control module (ECM) sends an input via GMLAN serial data to the BCM indicating the transmission is in the PARK position.
  - The BCM determines the brake pedal is applied according the brake pedal position.

Since the shift lock control solenoid is permanently grounded, the BCM supplies voltage to the automatic transmission shift lock control solenoid, mechanically locking the shift lever in the PARK position as the solenoid energizes. When the brake pedal is applied, the BCM turns the control voltage output of the shift lock control solenoid OFF, de-energizing the shift lock control solenoid. The de-energized solenoid releases the mechanical lock allowing the driver to move the shift lever out of the PARK position. When the transmission is out of the PARK position, the shift lock control solenoid remains de-energized.

Note: If equipped with push button start, the BCM supplies voltage to the automatic transmission shift lock control solenoid, mechanically unlocking the shift lever in the PARK position as the solenoid energizes.

During remote start operation, the BCM will energize the shift lock control circuit, locking the shift lever in the PARK position.

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